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the Cordilleran orogen:
Baja-BC resolved**

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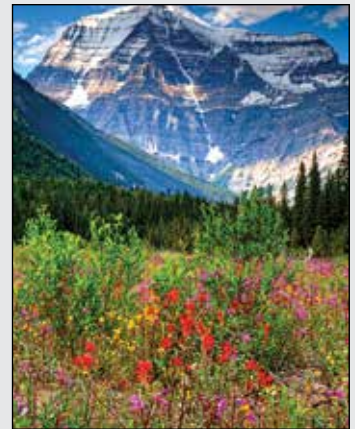
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SCIENCE

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Robert S. Hildebrand

Cover: The 3-km southwest face of Mount Robson (3,954 m) rises above summer wildflowers along Robson Creek in British Columbia, Canada. Composed of Cambrian sedimentary rocks, the peak is the most prominent in the Canadian sector of the Cordilleran fold-thrust belt. Photo by Robert S. Hildebrand. See related article, p. 4–11.



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Erratum: On page 22 of the October 2015 issue of *GSA Today*, David M. Raup was listed as the first president of the Paleontological Society. He in fact was president in 1977 (the first president was J.M. Clarke in 1909). *GSA Today* regrets this error.

Dismemberment and northward migration of the Cordilleran orogen: Baja-BC resolved

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ABSTRACT

Paleomagnetic results indicate that much of the North American Cordillera migrated more than 1000 km northward during the 80–58 Ma Laramide event, yet geologists cannot find either the faults along which such movement might have taken place or readily identifiable piercing points to document offset. Here, I suggest that the sinistral Texas Lineament, which extends west-northwest from the Gulf of Mexico to the Cordilleran fold-thrust belt southwest of Las Vegas, and the sinistral Lewis & Clark transverse zone, located about 1300 kilometers to the north, and extending from southern Vancouver Island east-southeast to the thrust belt in the Helena salient, can be restored to one through-going zone to provide a piercing point that constrains meridional migration. I interpret the zone as the result of plate interactions on a left-stepping transform margin formed along the southern margin of North America during Jurassic opening of the Atlantic Ocean. The structure was dismembered and partly transported northward along faults in and/or adjacent to the Cordilleran fold-thrust belt. The proposed restoration also reunites two conspicuous bands of Late Cretaceous–Paleocene slab-failure plutons and porphyry copper deposits into a single zone extending continuously along western North America. This reconstruction obviates the need for Laramide flat slab subduction.

INTRODUCTION

One of the more contentious aspects of North American Cordilleran tectonics is the possible meridional migration, based mostly on paleomagnetic evidence, of large sections of crust (Kerr, 1995). This is the so-called Baja-BC controversy, which was born when paleomagnetists discovered anomalously shallow paleomagnetic inclinations in Cretaceous rocks of the Canadian Cordillera relative to those obtained from rocks of cratonic North America (Beck and Noson, 1972; Irving, 1979, 1985). The data imply that a major portion of the coastal Cordillera of British Columbia migrated northward >1000 km between about 90 and 60 Ma (Irving, 1985; Irving et al., 1996; Enkin, 2006).

Geologists soon developed models that incorporated the paleomagnetic data (Umhoefer, 1987; Johnston, 2001, 2008; Butler et al., 2001; Umhoefer and Blakey, 2006; Hildebrand, 2013) but failed to present obvious matches between rocks of British Columbia and those much farther south. So, even

though (1) paleomagnetic data were compelling (Beck 1991); (2) the method worked well elsewhere in the world (Mac Niocaill et al., 2003); and (3) the long-standing northerly orientation of the Cordilleran margin would seem to be ideal for paleomagnetic studies, the geological community hasn't accepted that thousands of kilometers of translation had occurred because piercing points weren't readily located and because geologists couldn't identify the faults along which such large displacements took place (Kerr, 1995; Mahoney et al., 1999; Nelson et al., 2013).

In this contribution, I show that meridional migration within the Cordillera was not confined to narrow slivers along the coast, but instead involved the entire width of the Cordillera, from the Laramide fold-thrust belt westward, as hypothesized by Enkin et al. (2006a), Johnston (2008), and Hildebrand (2009, 2013). By utilizing simple cross-cutting relationships and two piercing points to constrain and support large-scale meridional migration, I bring the paleomagnetic data into consilience with the geological data to resolve the longstanding Baja-BC controversy.

GEOLOGY

Decades ago Phil King (King, 1969) divided the Cordillera into three along-strike sectors—northern, central, and southern—based on geological differences across two transverse boundaries: the Lewis & Clark transverse zone of Montana and Idaho and the Texas Lineament, which was considered to extend from the Transverse Ranges of California to the Gulf of Mexico. Regarding the southern boundary, he wrote (p. 72):

The zone is a strip of country as much as 160 km (100 miles) wide that separates two parts of the Cordillera with different topographies, geologic histories, and styles of deformation. South of the zone the Cordilleran fold-belt extends 800 km (500 miles) farther east than on the north side, and for long distances its deformed rocks closely adjoin little deformed rocks in the Colorado Plateau and the block mountains of New Mexico, which are reactivated or disrupted parts of the former craton. These contrasts have not been produced by transverse faulting, and the Texas Lineament is not a through-going fault zone, as has sometimes been assumed.

In my earliest paper on the Cordillera (Hildebrand, 2009), I noted the many changes along the southern margin of the Colorado Plateau and hypothesized that there must be a fault, which I called the Phoenix fault, separating the non-extended Colorado Plateau from the extended zone to the south. At the time, I was unaware of King's boundaries and was flummoxed because I could not decide whether the fault was transform or

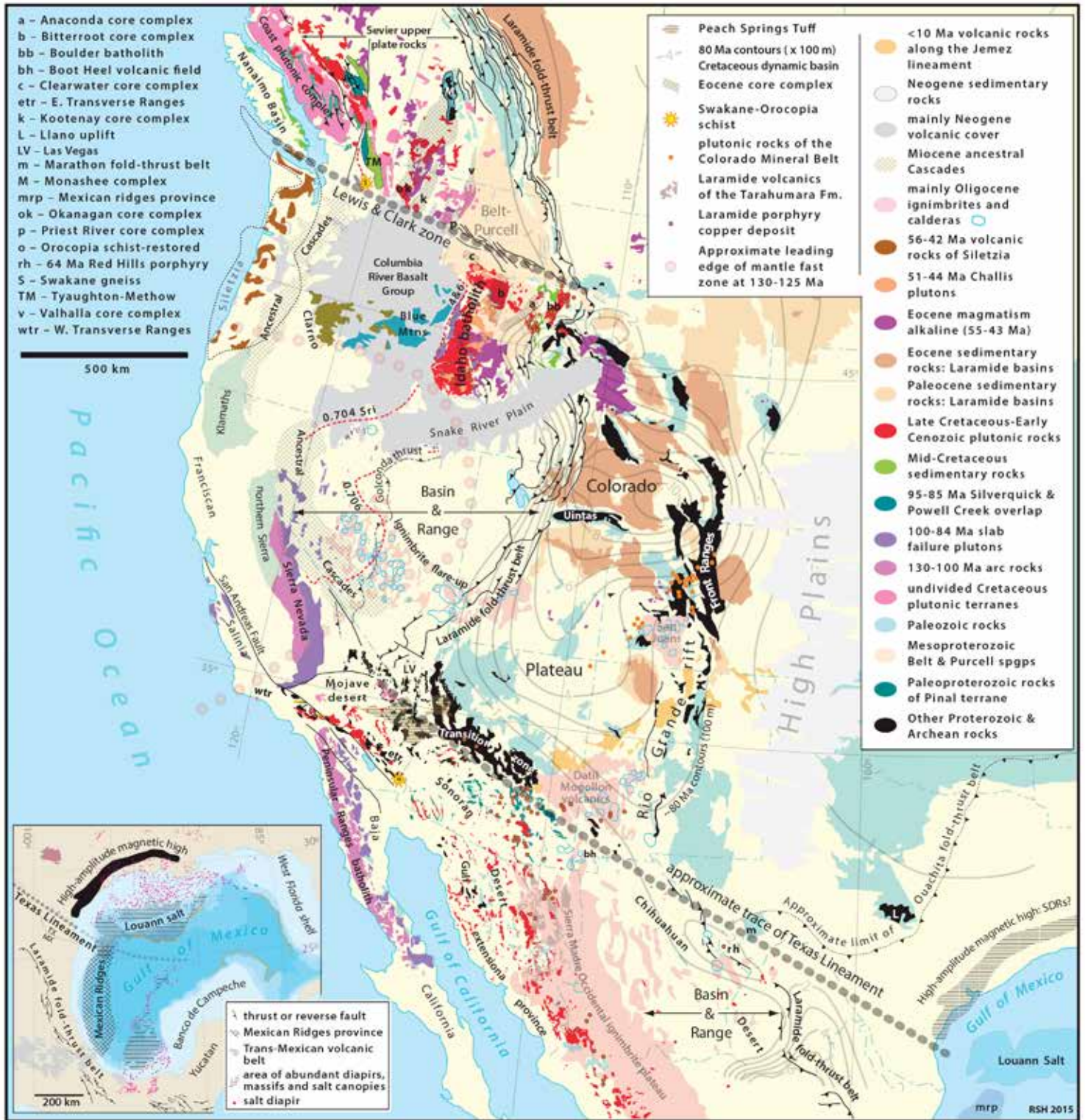


Figure 1. Geological sketch map of west-central North America showing the two transverse structural zones and geologically relevant units. Geology from Reed et al. (2004) with local detail from sources cited in the text; 80 Ma contours of Cretaceous rocks from Roberts and Kirschbaum (1995); Great Basin calderas from Henry and John (2013); Late Cretaceous-Paleocene Sr, isopleths from Armstrong et al. (1977). Inset: The Gulf of Mexico region simplified from Reed et al. (2004) showing the sinistral separation of Gulf salt (reflected in salt domes) and the southward truncation of the high-amplitude magnetic high that is interpreted to represent basalts of a volcanic rifted margin (Mickus et al., 2009). The Mexican ridges province is characterized by detachments in shale, whereas elsewhere in the Gulf, detachments are in salt (Rowan et al., 2004).

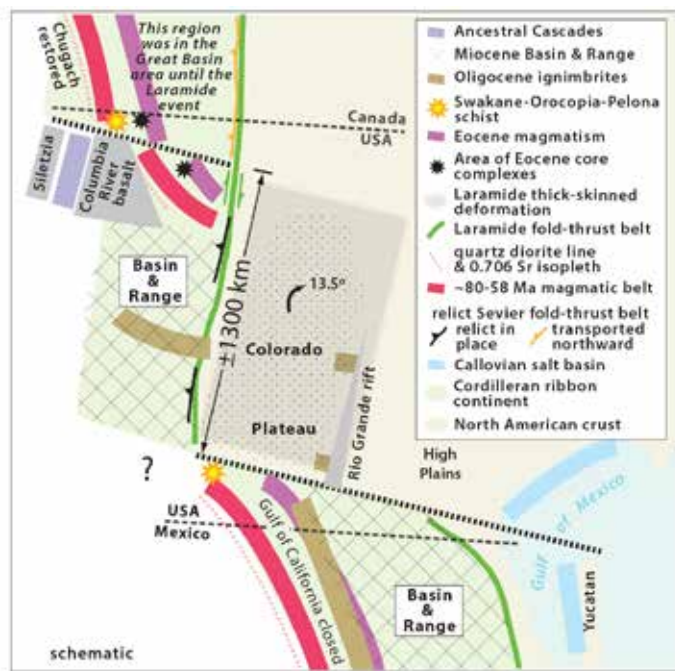


Figure 2. Simplified map showing many of the main Cordilleran elements discussed in the text. Rotation of Colorado Plateau from Kent and Witte (1993).

transcurrent. For example, it was obvious that, in addition to the thrust belt, the Neogene Basin and Range structural province occurs much farther west, north of the lineament, than its equivalent in Mexico (Fig. 1), yet I knew that it couldn't be a younger transcurrent fault because 18.8 Ma Peach Spring Tuff (Fig. 1) crops out in a narrow band from Arizona to near Barstow, California (Glazner et al., 1986) and extends unbroken over the trace of the zone.

Besides the separation of the Basin and Range and the thrust belt, many other features display sinistral separation across the lineament (Fig. 1): The post-Sevier dynamic basin (as illustrated by the 80 Ma isopachs), the Laramide belt of porphyry copper deposits (Gilmer et al., 2003), and possibly the Oligocene ignimbrite flare-up (Henry and John, 2013) all show sinistral separation. The oldest rocks that show obvious sinistral separation across the zone are the Callovian salt deposits of the Gulf of Mexico (Fig. 1).

Features restricted to the region north of the Texas Lineament include the Colorado Plateau, the Rio Grande rift, the High Plains province, and the Ouachita-Marathon orogen. Features largely limited to the region south of the lineament include the Sonoran batholith, related porphyry Cu deposits, and the Pinal schist (Fig. 1).

The Rio Grande rift disappears southward into the Mexican Basin and Range, whereas the unbroken High Plains just west of the 100th meridian trend southerly into the Mexican Basin and Range (Figs. 1 and 2). Paleozoic features, such as the Ouachita-Marathon fold-thrust belt and strata of the Permian Basin, are truncated and do not appear south of the lineament, whereas the much younger Late Cretaceous–Paleocene Sonoran batholith extends northward into Arizona but remains mostly south of the lineament and extends westward through the Transverse Ranges, where it ends (Fig. 1). The northwesterly tip of the Texas

Lineament zone is obscure and cannot be traced beyond the area just southwest of Las Vegas, where the Cordilleran fold-thrust belt also appears to terminate in the complexly faulted Mojave region of eastern California (e.g., figure 14 in Burchfiel et al., 1992).

The Lewis & Clark transverse zone (Fig. 1), which King (1969) used to separate the central from the northern Cordillera, is similar to the Texas Lineament in that it ends at the Laramide thrust belt, and most units north and south display sinistral separation or are truncated against it (Figs. 1 and 2). Late Cretaceous–Paleocene magmatic rocks in Idaho and Montana, of which the Idaho and Boulder batholiths are examples, continue north of the zone but display a sinistral step before continuing farther northward through the High Cascades and the Coast plutonic complex of British Columbia (Fig. 1).

Following the same trends as the plutonic rocks is the prominent left step in the initial Sr isopleths of Late Cretaceous–Paleocene rocks (Armstrong et al., 1977; Fleck and Criss, 1985). A few plutons of a 100–80 Ma plutonic belt—interpreted farther south as slab-failure plutons related to the 100 Ma Oregonian event (Hildebrand and Whalen, 2014)—occur within the Idaho batholith and to the west in the Cascades and Coast plutonic complex north of the zone. Eocene magmatism and core complexes (Foster et al., 2007) also display a sinistral separation across the zone (Fig. 1), whereas three other Cenozoic groups of rocks—dikes and lavas of the Columbia River Basalt Group (Reidel et al., 2013), volcanic and sedimentary rocks of the Ancestral Cascades (du Bray and John, 2011), and dominantly basaltic rocks of Siletzia (Wells et al., 2014)—all abut northward against the zone (Figs. 1 and 2). The classic Laramide basement uplifts and basins (Fig. 1), characteristic of the central Cordillera, are largely confined to the area south of the Lewis & Clark zone and north of the Texas Lineament (Fig. 1).

Based on the absence of sinistral separation across them, rocks of the Belt Supergroup appear to sit atop the Lewis & Clark transverse zone, but the zone expresses itself in the overlying Belt rocks with a linear band of abundant faults, folds, and intense cleavage (Wallace et al., 1990; Sears, 1988). A conspicuous band of Late Cretaceous sedimentary rocks located west and south of the Boulder batholith (Fig. 1) is an order of magnitude thicker, and is stratigraphically quite different, south of the zone than correlative rocks to the north in the Montana disturbed belt (Wallace et al., 1990). Jurassic-Cretaceous rocks of the Tyaughton-Methow basin (Umhoefer et al., 2002), and those of the Upper Cretaceous Nanaimo basin on Vancouver Island (Mustard, 1994) do not continue south of the transverse zone (Fig. 1).

BAJA-BC RESOLVED

Several robust and repeatable paleomagnetic studies exist for the region north of the Lewis & Clark zone. I summarize the results of several, plus an interesting study of leaf fossils that yielded congruent results, in Figure 3. The results are similar, but those from older Cretaceous rocks have slightly larger amounts of displacement relative to the craton, largely because North America started to move southward at 90 Ma (Kent and Irving, 2010).

A breakthrough in our understanding occurred through paleomagnetic study of the Carmacks Group (Fig. 3), which yielded ca. 70 Ma paleopoles indicating 1950 ± 600 km northward translation relative to cratonic North America (Enkin et al., 2006a). The group is an amalgamation of 72–69 Ma volcanic and sedimentary

rocks located in the Canadian Cordillera north of Whitehorse (Fig. 3). Rocks of the group sit unconformably on rocks of the Yukon-Tanana terrane, which collided and joined with Cassiar platform and Selwyn basin during the Late Permian (Berenek and Mortensen, 2011); were all overlapped by Triassic conglomerate (Berenek and Mortensen, 2007); and cut by abundant mid-Cretaceous plutons (Rasmussen, 2013). Thus, the paleomagnetic results from much younger rocks of the Carmacks Group apply to those terranes as well (Gladwin and Johnston, 2006). The results, supported by data from earlier, but less conclusive, studies farther south in the Canadian Front Ranges (Enkin et al., 2000) led Randy Enkin to conclude that the majority of northward translation took place on “unidentified structures located east of the Selwyn basin” (Enkin et al., 2006a).

Paleomagnetic studies farther south in Albian-Cenomanian turbiditic rocks of the Blue Mountain terranes, Oregon, yielded paleopoles 1760 ± 460 km discordant to North American poles at about 93 Ma (Housen and Dorsey, 2005). Rocks of the Blue Mountains–Riggins terranes were joined to rocks of the Belt Supergroup along the Salmon River suture between 111 and 90 Ma (Manduca et al., 1993; Unruh et al., 2008), and, because rocks of the Belt Supergroup form one giant allochthon (Sears, 2007; Fuentes et al., 2012) that was thrust over Upper Cretaceous sedimentary rocks in the Cordilleran fold-thrust belt, the paleomagnetic results from the Ochoco Basin should apply to rocks of the Belt Supergroup as well. These results are consistent with the Carmacks results and together indicate that northward migration of the entire Cordilleran tectonic collage took place along faults within or east of the Cordilleran fold-thrust belt after about 70 Ma.

I recognized (Hildebrand, 2013, 2014) that the 125–105 Ma Sevier event was separate and distinct from the 80–58 Ma Laramide event and confined to the Great Basin sector of the orogen. And, based on geological and geophysical features, such as the distribution of eastwardly vergent thrusts, the lack of an arc on North American crust, and compelling new mantle tomography (Sigloch and Mihalynuk, 2013), I argued that subduction was westerly dipping. I also noted that slab-failure magmatism and thrust faults related to the Sevier event are not found in the Great Basin west of the fold-thrust belt where expected, but instead are located in the Canadian Cordillera. This, along with the Carmacks paleomagnetic data, and evidence that the Laramide foredeep migrated northward during the latest Cretaceous–Paleocene (Cataneanu et al., 2000; Roberts and Kirschbaum, 1995), led me to argue that the entire Cordillera migrated northward during the Laramide event (Hildebrand, 2014). However, other than the band of likely slab-failure plutons and the mismatched thrust belts, I presented no real piercing points, so the arguments, although cogent to some, were not compelling to all.

The left-stepping nature of the geology along both the Lewis & Clark transverse zone and the Texas Lineament, their similar orientations, and the observation that both appear to be truncated at the Laramide fold-thrust belt, suggest that the two zones were once continuous and separated during the Laramide event on one or more faults in, or adjacent to, the thrust belt. Currently, the two zones are ~1300 km apart. Paleomagnetic studies from the Carmacks volcanics and the Blue Mountains terranes have paleopoles 1760 ± 460 and 1950 ± 600 km discordant to cratonic North

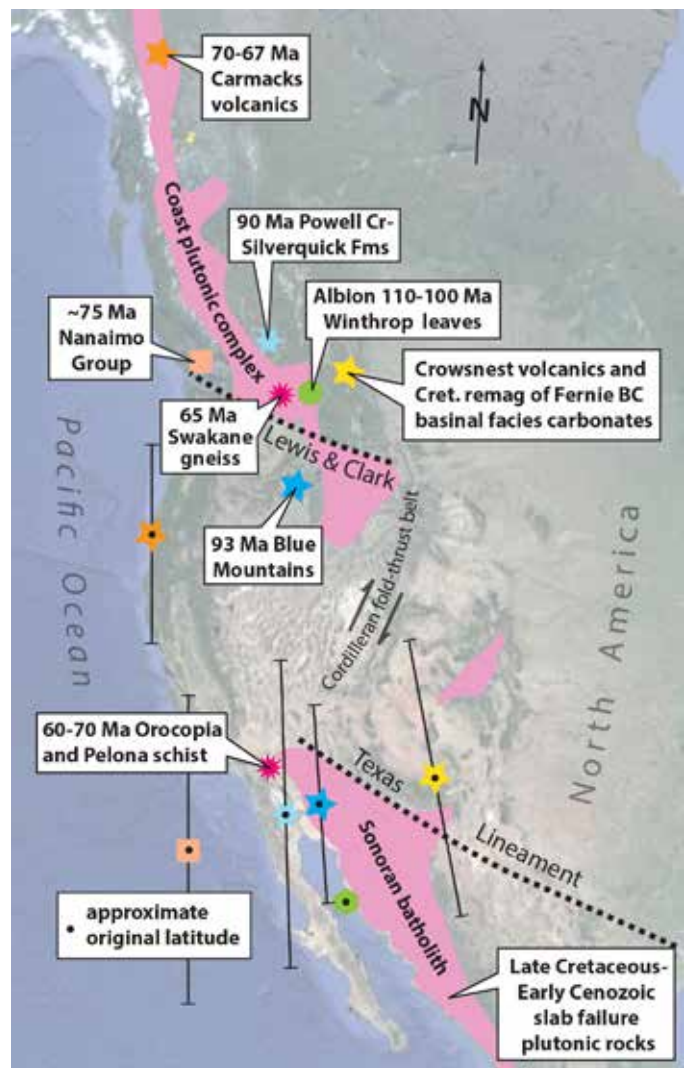


Figure 3. Google Earth® map showing key paleomagnetic results for mid- to Upper Cretaceous rocks and separation of Late Cretaceous–Early Cenozoic Laramide slab failure rocks. Symbols without inner black dots are current locations, whereas those with dots are their paleomagnetically restored latitudes. Note that restoring the Lewis & Clark zone with the Texas Lineament is consistent with the paleomagnetic data and also reunites the Laramide magmatic belt. Leaf margin data from Miller et al. (2006); Nanaimo points from Kent and Irving (2010) and Kim and Kodama (2004); Carmacks from Enkin et al. (2006a); Silverquick–Powell Creek from Enkin et al. (2006b); Fernie, British Columbia (BC), from Enkin et al. (2000); Blue Mountains from Housen and Dorsey (2005).

America, respectively (Housen and Dorsey, 2005; Enkin et al., 2006a) so they support the geological restoration. Thus, the transverse zones provide a piercing point consistent with the paleomagnetic data (Fig. 3).

I propose that the restored transverse zone represents a step in the southern margin of North America, and—because the oldest known rocks to exhibit sinistral separation across the zone are Callovian salt deposits beneath the Gulf of Mexico—that it formed as a sinistral transform fault during Jurassic opening of the central Atlantic Ocean. The northwest extent of the zone is located today around southern Vancouver Island, but the

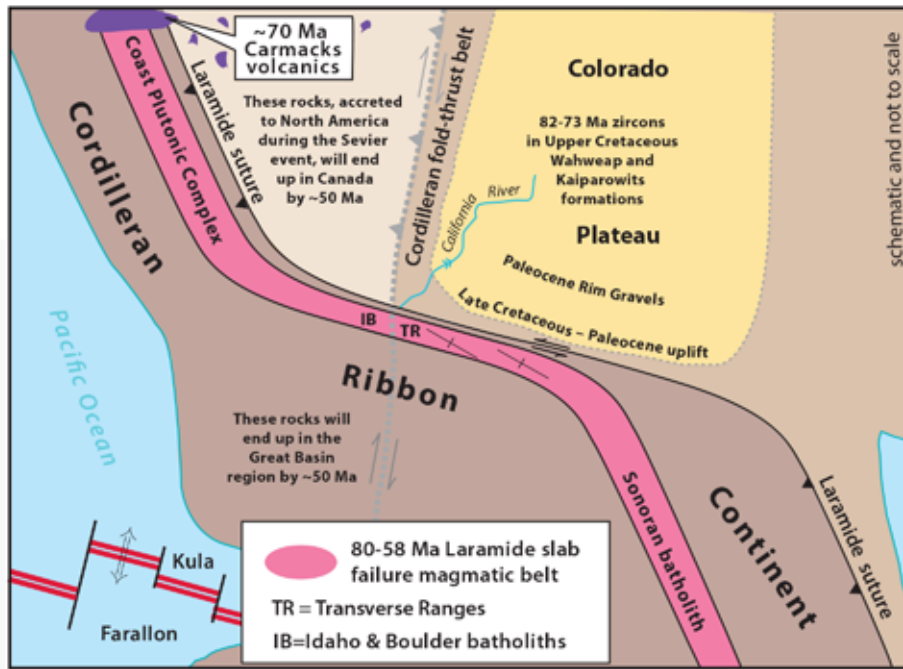


Figure 4. Much simplified reconstruction of margin just prior to northward migration illustrating continuity of Late Cretaceous–Early Tertiary magmatic belt. The sinuous shape of the magmatic belt reflects the shape of the southwestern margin of North America immediately after terminal collision of the Cordilleran Ribbon Continent.

Cordilleran fold-thrust belt terminates just southwest of Las Vegas and to the south resumes ~800 km farther east, as noted by King (1969). South of the zone, terranes collided with North America much farther east than to the north, but the overall geology is similar in many respects simply because some of the same events took place on both sectors of the continental margin. Others, such as deformational features related to the 125–110 Ma Sevier event, have no recognized counterpart to the south because the impinging block, which Stephen Johnston and I (Johnston, 2008; Hildebrand, 2013) argued to have been a ribbon continent, did not arrive there until much later, as suggested by the coincidence of the distinctive eastward-extending prong of the mantle fast-zone (Sigloch and Mihalynuk, 2013), and the meridionally restored location of the Great Basin region, at about 125 Ma (Hildebrand, 2014).

A major Late Cretaceous–Paleocene magmatic belt, interpreted by Hildebrand (2013) to represent Laramide slab failure magmatism and metallogensis, extends from Alaska to just south of the Lewis & Clark transverse zone and from southern Mexico to the Transverse Ranges (Figs. 1 and 2). It provides another robust piercing point. The present-day magmatic gap in between the two was perhaps the most important reason to ascribe Laramide thick-skinned deformation to flat-slab subduction (Dickinson and Snyder, 1978; Humphreys, 2009), but by reuniting the transverse zones, the two belts of Laramide magmatism and their related porphyry copper deposits are joined, obliterating the magmatic gap and validating the overall reconstruction (Fig. 4).

It is worth noting that the Laramide magmatic belt has exhumation ages of 70–50 Ma over its entire length (Miller and Morton, 1980; Wells and Hoisch, 2008; Miller et al., 2009; Armstrong, 1988) and that there are two bands of Laramide deformation: the better known band, mostly without proximal magmatism, located in the eastern Cordillera, and another with associated high-grade metamorphism and generally rapid

exhumation located farther west in or adjacent to the magmatic belt. The deformation, magmatism, and exhumation are well known throughout the Transverse Ranges and Mojave Desert region of Southern California and Arizona (Haxel et al., 1984; May, 1989; Needy et al., 2009), as well as in the Cascades and Coast plutonic complex of British Columbia and the Yukon (Miller et al., 2009; Rusmore and Woodsworth, 1991; Parrish, 1992; Evenchik et al., 2007; Johnston and Canil, 2007).

Overall, the proposed reconstruction resolves many long-standing issues in Cordilleran geology and hints at solutions to many more. Not only are the paleomagnetic data accounted for, and the Baja-BC controversy resolved, but the currently dismembered Laramide magmatic, deformational, and metamorphic collisional belt is reunited and validates the reconstruction. Hopefully, this initial first-order model will lead others to work backward through time to better understand the development of the Cordilleran orogen. Many more surprises are yet to come.

CONCLUSIONS

1. Similar relationships of well-dated and mapped units along both sides of the Lewis & Clark zone and the Texas Lineament suggest that the two features were formerly continuous.
2. By restoring 1300 km of dextral slip along the Cordilleran fold-thrust belt—about the minimum indicated from paleomagnetic data—the Lewis & Clark transverse zone and the Texas Lineament are aligned into a continuous structure. The reconstruction is simple and clarifies many relationships that were previously difficult to explain.
3. In the reconstruction (Fig. 4), the Laramide collision zone and its exhumed upper-plate slab-failure rocks occur in a continuous band from southern Mexico through the Transverse Ranges into the Cascades and Coast plutonic complex. Thus, there was no magmatic gap during the Laramide.

4. Although they collided with North America in the Great Basin sector at about 125 Ma, the upper plate rocks accreted to North America during the Sevier event migrated northward during the Laramide and, because the various terranes in the upper plate were amalgamated prior to the Laramide event (Hildebrand, 2013), now span nearly the entire width of the Canadian Cordillera.
5. The Cordilleran fold-thrust belt, located in the eastern Cordillera from about Las Vegas northward, typically has no associated magmatism and is a Laramide transpressive feature accommodating the northward migration of rocks previously accreted to the Great Basin sector of the margin during the 125–110 Ma Sevier event.
6. If the rapid northward migration of the Kula plate drove the Cordilleran block northward as many believe, then the model constrains the long-uncertain position of the Kula-Farallon spreading ridge (Engebretson et al., 1985) to have been at least 1300 km south of the current location of the Cordilleran block—about the latitude of La Paz, Mexico (Fig. 4).
7. Some Eocene and younger rocks, such as those of the Columbia River Basalt Group, the Ancestral Cascades, and Siletzia, abut directly against the remaining south-facing margin, illustrating that the transform margin maintained a strong influence on the distribution of geological units for about 100 m.y.

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Travel Grant and Mentor Program for Early-Career Scientists and Students

35th International Geological Congress (IGC)

Cape Town, South Africa ✱ 27 August–4 September 2016

The Geological Society of America is accepting applications for the 35th International Geological Congress (IGC) Students and Early Career Scientists Travel Grant and Mentoring Program. This program is organized in collaboration with the GSA Foundation and the U.S. National Committee for Geological Sciences of the National Academy of Sciences. To be eligible, the applicant must be a resident or citizen of the United States and be enrolled in, or employed at, a U.S. institution. Early career scientists are defined as those within seven years of receiving their Ph.D. Each award is anticipated to be a maximum of US\$3,5500.

In addition to the online form and résumé, the following supplemental information will be required: A cover letter addressing your reasons for attending the meeting and a prioritized budget of expenses, proof of abstract submission, a copy of the submitted abstract, and two letters of reference.

Applications will be available in mid to late December. The online application and supplemental material must be received electronically no later than **20 February 2016**. Applicants will be notified of the results by 30 April 2016.

Questions? Please contact Jennifer Nocerino at jnocerino@geosociety.org.



2015–2016 Richard H. Jahns Distinguished Lecturer



Jerome V. De Graff has been named the Richard H. Jahns Distinguished Lecturer for 2015–2016. This lectureship was jointly established in 1988 by the Association of Environmental & Engineering Geologists (AEG) and the Environmental and Engineering Division of the Geological Society of America (GSA) to increase student awareness about applied geology.

Having retired in February 2014, De Graff brings his 36 years of experience as a geologist for the USDA Forest Service in Utah and California, USA, to this coming year's lectureship. "I was fortunate to work for a land management agency where a variety of projects needed geologic information. And for the opportunity to be officially sent to work on projects or teach in Italy, Bulgaria, Thailand, Guatemala, and several countries in the Caribbean," says De Graff. He also notes, "I never imagined how much my work as a geologist would involve being an integral part of an emergency response or disaster preparedness action."

De Graff continues his geology career, periodically teaching graduate courses for the Earth & Environmental Sciences Department at California State University (Fresno), writing professional papers, and being both a reviewer and editor for several journals. His first action after retirement was posting "Before the Smoke Clears..." on GSA's "Speaking of Geoscience" blog (<https://geosociety.wordpress.com/?s=after+the+smoke+clears>). His experience speaking to groups started before his geology career as an instructor from 1968 to 1973 for the Strassenburgh Planetarium in Rochester, New York, USA. Over the years, he has given a variety of talks at regional, national, and international venues.

A native of the Finger Lakes region of upstate New York, De Graff found his calling as a geologist while obtaining a B.S. in education and earth science at the State University of New York at Geneseo. Once employed, he soon realized an advanced degree would help his career and obtained an M.S. in geology at Utah State University. His thesis project involved mapping across a mountainous 595-square-mile-area managed by the USDA Forest Service on the Utah-Wyoming border, which ultimately resulted in his becoming the first forest-level environmental geologist in their Intermountain Region.

De Graff has drawn upon his background and experience to develop five topical presentations. Interested institutions should contact him at jdegraff@csufresno.edu to schedule one or more of the following talks:

1. Fire, earth & rain: Emergency response for wildfire-induced landslide hazards: Wildfire is a unique natural hazard because it poses immediate threats to life and property and creates conditions that can lead to subsequent debris flows and

accelerated rock fall. This is a significant problem in the western United States, where large wildfires have become more frequent since the mid-1980s. Limiting the impact of these post-fire geologic hazards requires determining their likelihood and location within the burned area. A rapid assessment is needed to ensure mitigation measures can be implemented prior to initiating rainfall.

2. What does it take to effectively monitor for environmental and engineering geology projects?: Monitoring is often part of environmental or engineering geology projects. Monitoring of surface crack development over an active coal mine, herbicide movement in groundwater, and long-term temperature and pH trends in an area of hot springs illustrate how this activity can develop information important to project objectives. This presentation will also explore how to ensure the effectiveness of monitoring efforts.

3. The challenges of providing landslide information during an emergency response: Geologists may find themselves becoming members of a team called as part of an emergency response to a destructive landslide. Being successful during such a stressful and intense assignment requires rapid acquisition of needed geologic information. De Graff will illustrate strategies for effectively accomplishing the tasks necessary to provide required information based on his experiences with a large landslide event that dammed a river in Dominica, West Indies, in 1997 and a large rock slide that buried a major highway in California in 2006.

4. Dealing with hazardous mine openings—blasting is not always a good option: Openings into abandoned mines can pose a physical hazard that is not always apparent to the general public. There is a continuing effort by state and federal agencies with mining or land management responsibility to implement measures to prevent people from entering abandoned mines. Often the suggestion to just "blast the opening shut" is advanced as being a reasonable way to handle the problem. This presentation explores a number of reasons why this approach is not as simple as it would appear and one situation where this option turned out to be the best approach.

5. The story of the Matthieu landslide-dam, Dominica, West Indies: Natural dams created by large landslides blocking rivers are found in many parts of the world. Upstream flooding from impounded water is often followed sometime later by downstream flooding. Consequently, these impacts call upon geologists involved with such events to make predictions or forecasts, especially about when later downstream flooding will take place. The behavior of the Matthieu landslide dam in the small island nation of Dominica in the eastern Caribbean clearly illustrates how far off the mark these predictions can be.

2016 Birdsall-Dreiss Distinguished Lecturer



Shemin Ge is professor of hydrogeology in the Department of Geological Sciences at the University of Colorado Boulder. She received her Ph.D. from Johns Hopkins University in 1990, subsequently worked at S.S. Papadopoulos and Associates, and then joined the University of Colorado in 1993. At the confluence of subsurface fluid flow physics and rock mechanics, Ge's early research examined the effects of tectonic deformation on paleo-fluid flow

dynamics in sedimentary basins. She has since moved on to explore interactions between groundwater and earthquakes.

Ge and her students and colleagues study earthquake-induced groundwater flow as natural experiments to reveal the hydrologic properties of geologic systems. They also explore the mechanisms of seismicity induced by reservoir operation and wastewater injection.

Another thread of Ge's research relates to groundwater resources and surface-groundwater interactions under a changing climate with a focus on headwater regions. She has also ventured into fracture flow and fault zone hydrology, as well as subsurface thermal energy transport and storage. A list of her publications can be found at www.colorado.edu/GeolSci/faculty/ge.htm.

Ge has served the hydrogeologic and broader geoscience communities in various capacities. She was chair of the Hydrogeology Program Planning Group for the Ocean Drilling Program from 1999 to 2002. She was editor for *Hydrogeology Journal* and associate editor for *Geofluids* and the *Journal of Ground Water*. She recently served a two-year term as program director for the Hydrologic Sciences Program at the U.S. National Science Foundation.

Interested institutions can schedule a visit via our online request form at <http://cugeology.org/ges>, or by contacting Shemin Ge at shemin.ge@colorado.edu. She will present a lecture on one or both of the topics described below. GSA's Hydrogeology Division is particularly interested in including liberal arts colleges in the itinerary. The Division pays transportation expenses, and the host institution is expected to provide local accommodations.

1. Fluid induced earthquakes: Insights from hydrogeology and poro-mechanics: Beginning in the 1960s, pore fluid pressure was identified as the primary culprit for inducing earthquakes reported near deep fluid-injection wells and newly built surface reservoirs worldwide. As these human activities continue and grow, induced seismicity has surged in recent decades at some but not all sites. This increase in seismicity raises the question of what fundamental hydrogeologic and poro-mechanics processes and parameters make some sites more prone to induced seismicity. This lecture will offer an overview and physical insights of fluid induced seismicity from hydrologic

and poro-mechanics perspectives. Two contrasting case studies are used to illustrate how pore fluid pressure could have played a role in observed seismicity, one near a deep-well fluid injection in the geologically quiescent region in the central U.S., and the other near a surface reservoir in a tectonically active region. A high rate of fluid input emerges as an important player in contributing to induced seismicity. The first few years of fluid injection or reservoir impoundment is typically a critical period when seismic hazard is elevated. While preexisting faults dictate earthquake locations, the spatial extent of pore pressure influence could reach tens of kilometers from fluid injection or reservoir impoundment sites. Continued research in this direction will not only offer a better understanding of the hydrogeologic and seismologic processes but also help to guide best practices in the quest for water and energy resources in coming decades.

2. Groundwater dynamics in headwater regions under a changing climate: Groundwater systems receive significant recharge in high-altitude headwater regions. Seasonal and longer term variations in surface temperature and precipitation are expected under a changing climate, which could substantially impact groundwater recharge and subsequently groundwater storage and discharge to surface waters downstream. These headwater regions are hydrologically sensitive to surface temperature changes due to the presence of frozen grounds that freeze and thaw seasonally and degrading permafrost. The freeze and thaw processes lead to changes in subsurface hydrologic properties and dynamically impede or invigorate groundwater flow. A key question is how seasonal and long-term surface temperature variations impact recharge to groundwater and its interaction with surface water. This presentation addresses this question as it relates to groundwater flow in headwater regions. Coupled heat transfer and groundwater flow processes are modeled for two headwater catchments, one in the Colorado Rocky Mountains and the other on the Tibet Plateau. These studies illustrate that shallow groundwater flow in summer and early fall is most energetic as thawed ground promotes snowmelt infiltration, invigorating the exchange between groundwater and surface water. Under increasing temperature scenarios, groundwater discharge to surface may experience a several-fold increase in magnitude over the decadal scale. While projected warming leads to increased groundwater discharge to surface waters, in the long run, insufficient recharge upstream will make it a challenge to sustain the discharge.



Upcoming

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2016 GSA Medals and Awards

- Penrose Medal
- Day Medal
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- Randolph W. "Bill" and Cecile T. Bromery Award for Minorities
- GSA Distinguished Service Award
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- Geologic Mapping Award in Honor of Florence Bascom
- Honorary Fellow

Nomination deadline: 1 Feb. 2016

GSA Fellowship

Elevation to GSA Fellowship is an honor bestowed on the best of our profession at each spring GSA Council meeting. **GSA Fellows** may support two nominees each year but only **one** as a primary nominator; **GSA members** who are not Fellows may be secondary nominators for up to **two** nominees. **Nomination deadline:** 1 Feb. 2016.

John C. Frye Environmental Geology Award

In cooperation with the Association of American State Geologists and supported by endowment income from the GSA Foundation's John C. Frye Memorial Fund, GSA makes an annual award for the best paper on environmental geology published either by GSA or by a state geological survey. **Nomination deadline:** 31 Mar. 2016.

2016 Student Research Grants

GSA is proud to offer research grants to its highly qualified student members. Students may receive a total of two GSA graduate student grants in their entire academic career, regardless of what program currently enrolled in. **The maximum award per grant is US\$2,500.** Students may also qualify for specialized awards; if so, the total awarded could be more than US\$2,500.

The GSA student research grant application process is online *only* at www.geosociety.org/grants/gradgrants.htm. No paper applications or letters will be accepted. Apply starting Dec. 2015. Submissions must be completed by Monday, 1 Feb. 2016, at 5 p.m. MST.

For further information on this program, go to www.geosociety.org/grants/gradgrants.htm, call +1-303-357-1060, or e-mail awards@geosociety.org.

2016 Post-Doctoral Research Awards

The following post-doc research awards are available. Learn more at www.geosociety.org/grants/postdoc.htm.

- The **Gladys W. Cole Memorial Research Award** for research on the geomorphology of semiarid and arid terrains in the United States and Mexico is awarded annually to a GSA member or Fellow between 30 and 65 years of age who has published one or more significant papers on geomorphology.
- The **W. Storrs Cole Memorial Research Award** for research on invertebrate micropaleontology is awarded annually to a GSA member or Fellow between 30 and 65 years of age who has published one or more significant papers on micropaleontology.

Application deadline: 1 Feb. 2016.

Other Awards

Call for Nominations: AGI Awards

AGI Medal in Memory of Ian Campbell

AGI Marcus Milling Legendary Geoscientist Medal

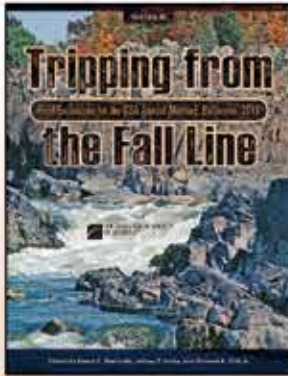
Go to www.agiweb.org/direct/awards.html to submit your nominations. **Nomination deadline:** 1 Feb. 2016.

Call for Nominations: National Awards

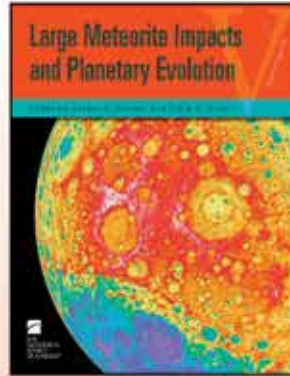
- **William T. Pecora Award:** <http://remotesensing.usgs.gov/pecora.php>.
- **National Medal of Science:** www.nsf.gov/od/nms/medal.jsp.
- **Alan T. Waterman Award:** www.nsf.gov/od/waterman/waterman.jsp.

Nomination deadlines vary.

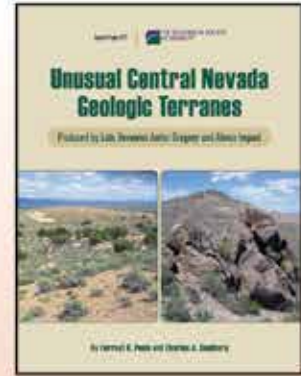
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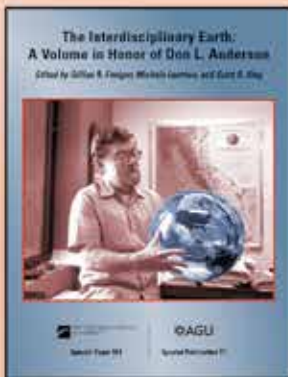
Tripping from the Fall Line: Field Excursions for the GSA Annual Meeting, Baltimore, 2015
 edited by David K. Brezinsky, Jeffrey P. Halka, and Richard A. Ortt Jr.
 FLD040, 578 p., ISBN 9780813700403
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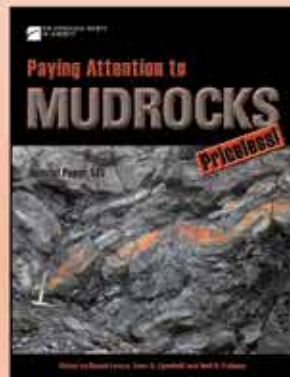
Large Meteorite Impacts and Planetary Evolution V
 edited by Gordon R. Osinski and David A. Kring
 SPE518, 227 p., ISBN 9780813725185
 \$60.00 | **member price \$42.00**



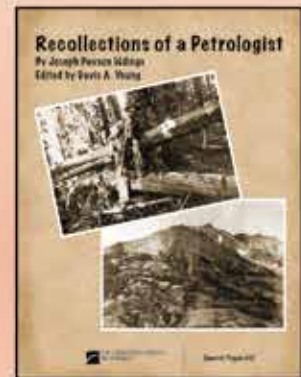
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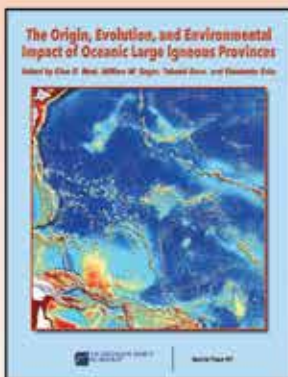
The Interdisciplinary Earth: A Volume in Honor of Don L. Anderson
 edited by Gillian R. Foulger, Michele Lustrino, and Scott D. King
 SPE514, 366 p., ISBN 9780813725147
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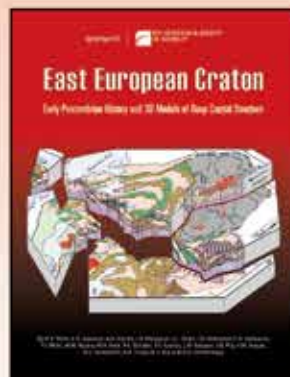
Paying Attention to Mudrocks: Priceless!
 edited by Daniel Larsen, Sven O. Egenhoff, and Neil S. Fishman
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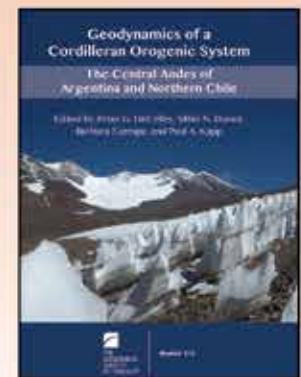
Recollections of a Petrologist
 by Joseph Paxson Iddings
 Edited by Davis A. Young
 SPE512, 208 p. plus index, ISBN 9780813725123
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 edited by Clive R. Neal, William W. Sager, Takashi Sano, and Elisabetta Erba
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 \$80.00 | **member price \$56.00**



East European Craton: Early Precambrian History and 3D Models of Deep Crustal Structure
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 SPE510, 433 p. plus CD-ROM, ISBN 9780813725109
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Geodynamics of a Cordilleran Orogenic System: The Central Andes of Argentina and Northern Chile
 edited by Peter G. DeCelles, Mihai N. Ducea, Barbara Carrapa, and Paul A. Kapp
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THE GEOLOGICAL SOCIETY OF AMERICA®

Congratulations to All the 2015 GSA Division Award Recipients



The primary Division awards were announced in the July 2015 issue of *GSA Today*; they are included again below along with other GSA Division awards presented at this year's annual meeting. Learn more about GSA's specialty Divisions at www.geosociety.org/divisions.

ARCHAEOLOGICAL GEOLOGY DIVISION

Rip Rapp Archaeological Geology Award
Francis (Frank) H. Brown, University of Utah

Claude C. Albritton, Jr., Memorial Student Research Award
Rachel Cajigas, University of Arizona

ENERGY GEOLOGY DIVISION

Gilbert H. Cady Award
Claus F.K. Diessel, University of Newcastle, Australia

Antoinette Lierman Medlin Field Award
Marisa Earll, University of Arizona

Antoinette Lierman Medlin Research Award
Severin Presswood, Southern Illinois University

ENGINEERING AND ENVIRONMENTAL GEOLOGY DIVISION

E.B. Burwell, Jr., Award
Priest, G.R., Schulz, W.H., Ellis, W.L., Allan, J.A., Niem, A.R., and Niem, W.A., 2011, Landslide stability: Role of rainfall-induced, laterally propagating, pore-pressure waves: *Environmental Engineering & Geoscience*, v. XVII, no. 4, p. 315–335.

Distinguished Practice Award
Jeff Keaton, Amec Foster Wheeler

Meritorious Service Award
Dennis Staley, U.S. Geological Survey

Richard H. Jahns Distinguished Lecturer (2014–2015)
Eldon Gath, Earth Consultants International

Roy J. Shlemon Scholarship Awards
Corina Cerovski-Darriau, University of Oregon
Stefanie Gugolz, University of Georgia
David Korte, Kent State University

GEOBIOLOGY & GEOMICROBIOLOGY DIVISION

Outstanding Contributions in Geobiosciences Award
Arpita Bose, Washington University in St. Louis
Tim Lyons, University of California, Riverside
Elizabeth Raff, Indiana University Bloomington
Rudolf Raff, Indiana University Bloomington

GEOINFORMATICS DIVISION

Outstanding Contributions Award
Lesley Wyborn, Australian National University

GEOLOGY AND SOCIETY DIVISION

Best Student Presentation Award
Genevieve Kidman, Southern Utah University
Stephanie Wong, Baylor University

GEOPHYSICS DIVISION

George P. Woollard Award
David A.D. Evans, Yale University

Allan V. Cox Student Research Award
Henok Kiflu, University of South Florida

Geophysics Division Student Research Award
Abigail Maxwell, Louisiana State University
Bradley Sparks, Colorado State University

GEOSCIENCE EDUCATION DIVISION

Biggs Award for Excellence in Earth Science Teaching
Kyle Gray, University of Northern Iowa

HISTORY AND PHILOSOPHY OF GEOLOGY DIVISION

Mary C. Rabbitt History of Geology Award
Léo F. Laporte, University of California Santa Cruz

Gerry and Sue Friedman Award for Distinguished Service
Kennard Baker Bork, Denison University

History and Philosophy of Geology Student Award
John A. Sime, University of North Carolina at Wilmington

HYDROGEOLOGY DIVISION

O.E. Meinzer Award
Brian Berkowitz, Weizmann Institute of Science

Birdsall-Dreiss Distinguished Lecturer
Clifford Voss, U.S. Geological Survey

George Burke Maxey Distinguished Service Award
William W. Simpkins, Iowa State University

Kohout Early Career Award
Michael Cardiff, University of Wisconsin–Madison

Hydrogeology Student Research Award
Alec Gierzynski, Northern Illinois University
Michael O'Connor, University of Texas at Austin
Madeyn Percy, University of North Carolina
Jonathan Reeves, University of Massachusetts
Brady Ziegler, Virginia Polytechnic Institute

LIMNOGEOLOGY DIVISION

Israel C. Russell Award
Andrew S. Cohen, University of Arizona

Kerry Kelts Student Research Awards
Ann Elisabeth Morey (Ross), Oregon State University

MINERALOGY, GEOCHEMISTRY, PETROLOGY, AND VOLCANOLOGY DIVISION

Distinguished Geologic Career Award
David A. Clague, Monterey Bay Aquarium Research Institute

Early Career Award
Frances Elaine Jenner, The Open University

MGPV Student Research Grant Award
John Buchanan, Colorado School of Mines
Nicholas Levitt, University of Wisconsin
Chelsea MacKaman-Lofland, University of Texas at Austin
Madison Myers, University of Oregon
William Nachlas, University of Minnesota
Demian Nelson, University of California Santa Barbara

PLANETARY GEOLOGY DIVISION

G.K. Gilbert Award
Matthew P. Golombek, Jet Propulsion Laboratory

Ronald Greeley Award for Distinguished Service
Michael Kelley, NASA

Stephen E. Dworkin Research Awards
Best Graduate Oral: **Robert E. Jacobsen**, University of Tennessee
Honorable Mention Graduate Oral: **Alison R. Santos**, University of New Mexico
Best Graduate Poster: **Hannah C.M. Susorney**, Johns Hopkins University
Honorable Mention Graduate Poster: **Jessica A. Watkins**, UCLA
Best Undergraduate Oral: **Jonathan Oulton**, Florida State University
Honorable Mention Undergraduate Oral: **Roger J. Michaelides**, Cornell University
Best Undergraduate Poster: **Hank M. Cole**, Colorado School of Mines
Honorable Mention Undergraduate Poster: **Amanda Stadermann**, Washington University in St. Louis

QUATERNARY GEOLOGY AND GEOMORPHOLOGY DIVISION

Kirk Bryan Award for Research Excellence
Daniel R. Muhs, Kathleen R. Simmons, R. Randall Schumann, Lindsey T. Groves, Jerry X. Mitrovica, and DeAnna Laurel, 2012, Sea-level history during the Last Interglacial complex on San Nicolas Island, California: Implications for glacial isostatic adjustment processes, paleozoogeography and tectonics: *Quaternary Science Reviews*, v. 37, p. 1–25, doi:10.1016/j.quascirev.2012.01.010.

Distinguished Career Award
George Denton, University of Maine

Farouk El-Baz Award
Marith Reheis, U.S. Geological Survey

Arthur D. Howard Student Research Grant
Mariah Richards, Colorado State University

J. Hoover Mackin Student Research Grant
Marina Foster, Arizona State University

Marie Morisawa Student Research Award
Sarah Schanz, University of Washington

Robert K. Fahnestock Memorial Award
Charles Shobe, University of Colorado Boulder

John A. Black Award
Ryan Frazer, University of North Carolina–Chapel Hill

John Montagne Research Award
Jotautas Baronas, University of Southern California

Gladys W. Cole Research Award
Lyman Persico, Whitman College

Congratulations to All the 2015 GSA Division Award Recipients *continued*

SEDIMENTARY GEOLOGY DIVISION

Laurence L. Sloss Award

Jody Bourgeois, University of Washington

Sedimentary Geology Division Student Research Award

John Chesley, University of South Carolina

STRUCTURAL GEOLOGY AND TECTONICS DIVISION

Career Contribution Award

Tanya Atwater, University of California, Santa Barbara

Outstanding Publication Award

Paper 1: **Konstanze Stübner, Lothar Ratschbacher, Daniel Rutte, Klaus Stanek, Vladislav Minaev, Maria Wiesinger, Richard Gloaguen, and Project TIPAGE members:** 2013, The giant Shakh dara migmatitic gneiss dome, Pamir, India-Asia collision zone: 1. Geometry and kinematics: *Tectonics*, v. 32, p. 948–979.

Paper 2: **Konstanze Stübner, Lothar Ratschbacher, Carsten Weise, Judy Chow, Jakob Hofmann, Jahanzeb Khan, Daniel Rutte, Blanka Sperner, Jörg A. Pfänder, Bradley R. Hacker, István Dunkl, Marion Tichomirowa, M.A. Stearns, and Project**

TIPAGE members: 2013, The giant Shakh dara migmatitic gneiss dome, Pamir, India-Asia collision zone: 2. Timing of dome formation: *Tectonics*, v. 32, p. 1–28.

Structural Geology & Tectonics Student Research Award

Cody Colleps, University of Texas at Austin

Michael Eddy, Massachusetts Institute of Technology

Brittany Huerta, California State University Northridge

Calvin Mako, Virginia Polytechnic Institute

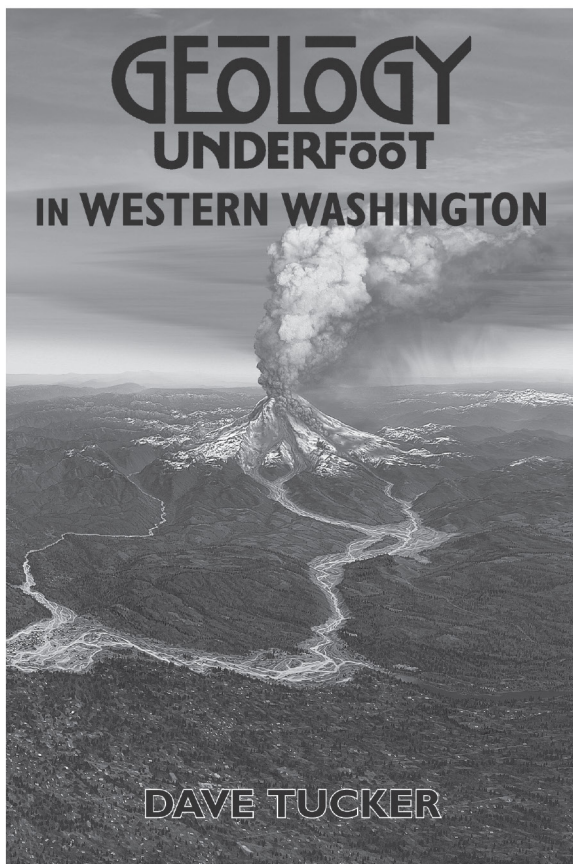
Louis Wersan, Indiana University

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Leadership support for the MAT program is provided by The Shelby Cullom Davis Charitable Fund.

The MAT program is supported in part by the New York State Education Department, the National Science Foundation under Grant Numbers DRL-119444 and DUE-1340006, and the U.S. Department of Education under Grant Number U3365140026.

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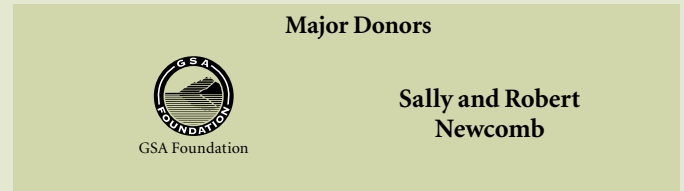


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GeoCorps™ America places geoscientists of all levels—university students, teachers, professionals, and retirees—in short-term geoscience projects on public lands throughout the United States. GeoCorps projects are hosted by three major federal partners—the Bureau of Land Management (BLM), the U.S. Forest Service, and the National Park Service (NPS) Geoscientists-in-the-Parks (GIP) program. Projects cover a wide variety of subjects related to the geosciences, including geology, hydrology, paleontology, soils, geohazards, mapping, GIS, education, and interpretation. GeoCorps positions are sponsored by individual donors and the organizations listed below. Most GeoCorps positions take place during the spring/summer season, but some also take place during the fall and winter.

Government Partners and Major Donors to the GeoCorps Program



GeoCorps was also funded by the following organizations in the past year:

- Badlands Natural History Association
- Bryce Canyon Natural History Association
- Friends of the Florissant Fossil Beds

- Glen Canyon Natural History Association
- Grand Canyon Association
- Rocky Mountain Conservancy
- Western National Parks Association

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Willamette National Forest

Phillip Goodling

Positions for spring/summer 2016 will be posted sometime after 1 Dec. 2015.

Positions for fall/winter 2016 will be posted 1 May 2016.

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Thank You

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In 2015, Mosaics in Science was supported through a public-private partnership between the National Park Service's Geological Resources and Youth Programs Divisions and The Geological Society of America.



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Manassas National Battlefield Park

Jaudat Raza

Mount Rainier National Park

Christina Andry

Olympic National Park

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Western Arctic National Parklands

Mariama Dryak

Photos from left to right: Janette Perez-Jimenez, Lava Beds National Monument. Background: Reina Galvan, Fire Island National Seashore, Northeast Coastal and Barrier Network. Salvador Silahua, San Juan Island National Historical Park.

GSA Education & Outreach Programs: 2016 Section Meetings

ON TO THE FUTURE (OTF)

Stop by the GSA Foundation booth at your Section Meeting's Welcome Reception to find out about applying to OTF, which provides travel support to students underrepresented in the geosciences to attend their first GSA Annual Meeting (the next one is 25–28 Sept. 2016 in Denver, Colorado, USA).

CAREER WORKSHOPS

Geoscience Career Workshop Part 1: Career Planning and Informational Interviewing

Your job-hunting process should begin with career planning, not when you apply for jobs. This workshop will help you begin this process and will introduce you to informational interviewing. This section is highly recommended for freshmen, sophomores, and juniors. The earlier you start your career planning the better.

Geoscience Career Workshop Part 2: Geoscience Career Exploration

What do geologists in various sectors earn? What do they do? What are the pros and cons of working in academia, government, and industry? Workshop presenters, and professionals in the field, will address these issues.

Geoscience Career Workshop Part 3: Cover Letters, Résumés, and CVs

How do you prepare a cover letter? Does your résumé need a good edit? Whether you are currently on the job market or not, learn how to prepare the best résumé possible. You will review numerous résumés to help you learn the important dos and don'ts of the process.

MENTOR PROGRAMS

Enjoy a free lunch while meeting with geoscience mentors working in the applied sector. The popularity of these programs means that space is limited, so plan to arrive early, because lunch is first-come, first-served. For further information, contact Jennifer Nocerino at jnocerino@geosociety.org.

South-Central Section: Baton Rouge, Louisiana, USA
Roy J. Shlemon Mentor Program in Applied Geoscience Luncheon: Monday, 21 March
John Mann Mentors in Applied Hydrogeology Luncheon: Tuesday, 22 March

Northeastern Section: Albany, New York, USA
Roy J. Shlemon Mentor Program in Applied Geoscience Luncheon: Monday, 21 March
John Mann Mentors in Applied Hydrogeology Luncheon: Tuesday, 22 March

Southeastern Section, Columbia, South Carolina, USA
Roy J. Shlemon Mentor Program in Applied Geoscience Luncheon: Thursday, 31 March

John Mann Mentors in Applied Hydrogeology Luncheon: Friday, 1 April

Cordilleran Section, Ontario, California, USA
Roy J. Shlemon Mentor Program in Applied Geoscience Luncheon: Monday, 4 April
John Mann Mentors in Applied Hydrogeology Luncheon: Tuesday, 5 April

North-Central Section, Champaign, Illinois, USA
Roy J. Shlemon Mentor Program in Applied Geoscience Luncheon: Monday, 18 April
John Mann Mentors in Applied Hydrogeology Luncheon: Tuesday, 19 April

Rocky Mountain Section, Moscow, Idaho, USA
Roy J. Shlemon Mentor Program in Applied Geoscience Luncheon: Wednesday, 18 May
John Mann Mentors in Applied Hydrogeology Luncheon: Thursday, 19 May

GSA Section Meetings Call for Mentors



PROFESSIONALS: *Interested in sharing information about your applied geoscience career with students?* Being a mentor is a rewarding experience. If you are interested in serving as a mentor at one of GSA's Section Meetings, contact Jennifer Nocerino at jnocerino@geosociety.org.

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 2016 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.

Geoscience Jobs & Opportunities

Ads (or cancellations) must reach the GSA advertising office no later than the first of the month, one month prior to the issue in which they are to be published. Contact advertising@geosociety.org, +1.800.472.1988 ext. 1053, or +1.303.357.1053. All correspondence must include complete contact information, including e-mail and mailing addresses. To estimate cost, count 54 characters per line, including punctuation and spaces. Actual cost may differ if you use capitals, boldface type, or special characters. Rates are in U.S. dollars.

Classification	Per Line for 1st month	Per line each add'l month (same ad)
Positions Open	\$9.15	\$8.90
Fellowship Opportunities	\$9.15	\$8.90
Opportunities for Students		
First 25 lines	\$0.00	\$5.00
Additional lines	\$5.00	\$5.00

Positions Open

MARSHALL-HEAPE CHAIR IN GEOLOGY TULANE UNIVERSITY

The Dept. of Earth and Environmental Sciences at Tulane University invites applications for the newly established Marshall-Heape Chair in Geology. We seek a scholar with an outstanding international reputation who will be appointed at the Full Professor level with tenure. We particularly seek a broad-based Earth scientist who complements current faculty expertise and offers potential for collaborative research. The Marshall-Heape Chair is expected to lead a widely recognized, externally funded research program that will attract Ph.D.-level graduate students and postdoctoral scholars of the highest caliber. Teaching duties are both at the graduate and undergraduate levels. For full consideration, applications should be received by January 10, 2016, but the position will remain open until filled. Applications should include a curriculum vitae, research and teaching statements that articulate how the mission of the department would be enhanced, and the names and contact information of at least three references. Applications must be submitted electronically via the following link: apply.interfolio.com/31900. Any inquiries may be directed to Dr. Torbjörn Törnqvist, Dept. of Earth and Environmental Sciences, Tulane University, 6823 St. Charles Ave., New Orleans, LA 70118-5698 (tor@tulane.edu). Further information about the department and university can be obtained at <http://tulane.edu/sse/eens>. Tulane University is an EEO/ADA/AA employer.

TENURE-TRACK FACULTY POSITION, WILLIAMS COLLEGE

The Geosciences Dept. at Williams College invites applications for a tenure-track appointment in geomorphology, at the rank of Assistant Professor, beginning 1 July 2016. We seek a colleague who is committed to excellence in teaching at the undergraduate level, who will provide a balance of classroom, field, and laboratory experiences for our students, and who can develop a vibrant and productive research program that engages undergraduates. The successful candidate will teach three courses per year (lectures plus labs). Teaching responsibilities typically include an introductory course in environmental/surficial geosciences, a departmental core course in geomorphology, and another upper-level course based on the candidate's

interests. Examples of such courses include, but are not limited to, tectonic geomorphology, critical zone processes, landscape dynamics, human perturbations, hydrology, or geographic information systems.

The Geosciences Dept. is committed to providing excellent training for future geoscientists, as well as teaching earth science as part of a balanced liberal arts education. Our department works closely with the Center for Environmental Studies at Williams College, and the successful candidate will be expected to mount courses that would be cross-listed with that program. The College is especially interested in candidates who can contribute to the growing diversity of the academic community through their teaching, scholarship and service. Enthusiasm for teaching, mentoring and advising a diverse population of students is essential. Further information about the department can be found at <http://web.williams.edu/Geoscience/>.

Applicants should have a Ph.D. or dissertation completed by the time of appointment, demonstrated teaching experience, and a vigorous research program suitable for undergraduate student involvement. Deadline for applications is 30 November 2015. We welcome applications from members of groups traditionally underrepresented in the field, and applicants are encouraged to state in their cover letter how they will enhance the diversity of offerings and educational experiences if hired. All offers of employment are contingent upon completion of a background check. Further information is available here: <http://dean-faculty.williams.edu/prospective-faculty/background-check-policy/>.

Candidates should apply via Interfolio (apply.interfolio.com/32106). The letter of application should include statements of teaching and research philosophy, curriculum vitae, and contact information for three references.

Williams College is a liberal arts institution located in the Berkshire Hills of western Massachusetts. The college has built its reputation on outstanding teaching and scholarship and on the academic excellence of its approximately 2,000 students. Please visit the Williams College website (www.williams.edu). Beyond meeting fully its legal obligations for non-discrimination, Williams College is committed to building a diverse and inclusive community where members from all backgrounds can live, learn, and thrive.

TENURE-TRACK FACULTY POSITION ENERGY GEOSCIENTIST DEPT. OF GEOLOGICAL SCIENCES UNIVERSITY OF ALABAMA

The Dept. of Geological Sciences at The University of Alabama invites applications for a tenure-track faculty position in energy geoscience, beginning August 2016, to be filled at the assistant professor level. Candidates are invited to apply who have specialties within any field of geoscience pertaining to energy exploration. Scientists with industry experience are encouraged to apply. Candidates must have a strong record of research and must have received a Ph.D. in geology, geophysics, or a related field at the time of appointment. The successful candidate will establish a vigorous, externally funded research program, develop relationships with the energy industry, work closely with the

Center for Sedimentary Basin Studies, and attract and advise high-quality graduate students. Teaching responsibilities will include undergraduate and graduate courses in her/his specialty and introductory geology. The department has a broad range of geophysical, geochemical, and computational facilities, in addition to University shared facilities, including the Dauphin Island Sea Lab. Departmental software includes industry standards such as ProMAX, Petrel, TechLog, PetroMod, Move, Petra, Geosoft, ArcGIS, and Matlab. Details regarding existing research programs, equipment and facilities, and departmental activities are at www.geo.ua.edu.

Questions should be directed to Dr. Fred Andrus (fandrus@ua.edu). Applicants should go to <http://facultyjobs.ua.edu> to electronically apply for this position. When submitting an application, candidates must provide a cover letter, CV, research and teaching statements, and a list with the contact information for at least three referees. Applications will be reviewed beginning **December 7, 2015**, and will continue until the position is filled. The University of Alabama is an Equal Opportunity Affirmative Action Employer and actively seeks diversity in its employees.

DEPARTMENT CHAIR TENURE-TRACK ASSISTANT PROFESSOR AND INSTRUCTOR DEPT. OF GEOGRAPHY AND GEOLOGY UNIVERSITY OF SOUTHERN MISSISSIPPI

The University of Southern Mississippi invites applicants for (i) a full-time, 12-month, tenure-track administrative faculty position as **department chair**, (ii) a full-time, nine-month, tenure-track faculty position as an **assistant professor of geology**, and (iii) a full-time, nine-month faculty position as an **instructor of geology** in the Dept. of Geography and Geology in the College of Science and Technology to begin in fall 2016 (July 1 for chair). Research and teaching specializations that are preferred for these positions are purposely broad and include one or more of the following: structural geology, geophysics, environmental geochemistry, mineralogy, petrography/petrology, invertebrate paleontology, stratigraphy, and/or other specialties pertinent to the Gulf Coast region. These positions require colleagues to balance a traditional geological curriculum with courses consistent with the candidates' expertise.

Department Chair (Posting 0003695): Applicants are required to have a Ph.D. in geology or a closely related field from an accredited university with a minimum of 18 hours of graduate coursework in geology or a closely related field. Further, candidates should have professional credentials sufficient to be considered eligible for appointment as a full professor. Expectations for this position include (1) providing leadership and direction in shared governance in areas of goal-setting and assessment, faculty recruitment, hiring, mentoring and tenure/promotion evaluation; (2) providing leadership and guidance to advance the research capabilities and scholarly activities of the department; (3) promoting and participating in an active research agenda within the department; (4) ensuring that academic programs in the department maintain high standards; (5) excellence in instruction of general education, advanced undergraduate, and graduate-level

courses in geology; (6) directing the administration of the department; and (7) service to the college, university and greater academic community.

Assistant Professor (Posting 0003736): Applicants are required to have a Ph.D. in geology or a closely related field from an accredited university with a minimum of 18 hours of graduate coursework in geology or a closely related field. Expectations for this position include (1) developing a consistent and productive externally funded research program that includes graduate and undergraduate students; (2) excellence in instruction of general education, advanced undergraduate and graduate-level courses; and (3) service to the department, college, university and greater academic community.

Instructor (Posting 0003737): Applicants are required to have a master's degree or Ph.D. in geology or a closely related field from an accredited university with a minimum of 18 hours of graduate coursework in geology or a closely related field. Expectations for this position include (1) excellence in instruction of general education and advanced undergraduate courses in geology; (2) advisement services to undergraduate geology students; (3) service to the department, college and university; and (4) public outreach and advocacy for geology in the community.

Applications must be submitted online at <https://jobs.usm.edu>. Required application materials can also be found at this website. Applications must be completed by December 1, 2015, to ensure full consideration for the chairperson position, and December 15, 2015, for the assistant professor and instructor positions. More information about the department can be found at www.usm.edu/geography-geology.

Founded in 1910, The University of Southern Mississippi is a comprehensive doctoral and research-driven university with a proud history and an eye on the future. A dual-campus university, Southern Miss serves students on campuses in Hattiesburg and Long Beach, in addition to five teaching and research sites in Mississippi and through Online at Southern Miss. Since 2006, Southern Miss students have collected seven Goldwater Scholarships, three Truman Scholarships and 14 National Science Foundation Graduate Research Fellowships. Our Center for Undergraduate Research affords our students meaningful research opportunities, and as a proven leader in innovation, we conduct transformative research that translates into real-world solutions. As one of a select number of institutions in the nation accredited in art, dance, music and theatre, we are a haven for creativity and artistic expression. In the classroom or lab, on the playing field, or in the performance hall, we strive to have a positive impact not only on our students, but also the world around us. Further information is found at www.usm.edu.

An Affirmative Action/Equal Employment Opportunity employer/Americans with Disabilities Act institution, The University of Southern Mississippi encourages minorities, women, veterans and persons with disabilities to apply.

**ASSISTANT/ASSOCIATE PROFESSOR
WATERSHED ANALYSIS
MONTANA STATE UNIVERSITY**

The Land Resources and Environmental Sciences Dept., Montana State University, Bozeman [<http://landresources.montana.edu>] seeking a talented and

enthusiastic individual to undertake a tenure-track, fiscal-year faculty position (63% research/ 27% teaching/ 10% service) in watershed analysis. Details of the position are available at [www.montana.edu/jobs/faculty]. Screening will begin January 15, 2016, until an adequate applicant pool has been established.

**PROFESSORSHIP IN PALEONTOLOGY
AND PALEOENVIRONMENTAL CHANGE
UNIVERSITY OF LAUSANNE**

The Faculty of Geosciences and Environment at the University of Lausanne invites applications for a professorship in Paleontology and Paleoenvironmental Change. The position will be based at the Institute of Earth Sciences. This professorship is dedicated to the understanding of evolutionary patterns during Earth history and their relationship with paleoenvironmental, paleoceanographic and paleoclimatic change.

A clear interest in fundamental research and a process-oriented and quantitative approach is requested. We particularly seek applicants with interest in establishing collaborative research projects with other Earth and environmental science disciplines. We will consider exceptional applicants from other domains of relevance to Paleontology and Paleoenvironmental Change. The successful candidate is expected to have a proven capacity or potential of developing an internationally competitive research program and to attract external funding.

The candidate must have a sufficient background in and a strong commitment to excellence in teaching of a range of paleontological topics, including field courses, at both undergraduate and graduate levels. Teaching activities will also include participating in doctoral programs and supervising Bachelor, Master and Ph.D. students. The ability to teach in French should be acquired within two years following the appointment. The appointment is expected at the Assistant Professor level (tenure track), with Associate or Full Professor status achieved within 5-6 years. However, exceptionally, we will consider outstanding candidates for direct appointment to the Full Professor level. The University of Lausanne is an equal opportunity employer. Applications from women are particularly encouraged.

Application deadline: **November 30, 2015**

Starting date: **August 1, 2016** (or as mutually agreed).

Applications are to be submitted by e-mail only in a single pdf file to the Faculty of Geosciences and Environment (paleo.gse@unil.ch), except for publications that may be submitted sequentially. The maximum file size that can be received by the University of Lausanne e-mail system is 30 MB. An automatic reply will acknowledge reception of the file. In case of problem, please contact ise.reymond@unil.ch. The application material should include:

1. Letter of motivation
2. Curriculum Vitae including the year of birth, the date of the Ph.D. thesis defense, and the title of the dissertation.
3. Complete list of publications
4. Statement of research and teaching goals and interest (not exceeding 4 pages)
5. The five most significant publications (pdf files)

6. The names and contact information of five referees knowledgeable with your work.

For any specific enquiries, please contact Prof. Stefan Schmalholz (stefan.schmalholz@unil.ch), Director of the Institute of Earth Sciences.

**THREE ASSISTANT PROFESSOR POSITIONS
DEPT. OF GEOLOGY & GEOGRAPHY
WEST VIRGINIA UNIVERSITY**

The Dept. of Geology and Geography at West Virginia University seeks to fill three geology faculty positions. Applicants should have a Ph.D. or equivalent degree in geology, earth science or related field by the start date. Review of applications for all positions will begin January 15, 2016 and continue until each position is filled; start date for all positions is August 15, 2016.

Paleobiology: We seek to hire a full-time (9-month), tenure-track Assistant Professor specializing in Paleobiology, which could include expertise in Invertebrate or Vertebrate Paleontology, Micropaleontology, Paleoecology, Paleobotany/Palynology, Ichnology, or related fields. The successful candidate will be expected to develop a vigorous externally-funded research program, teach core undergraduate classes in paleontology, graduate courses in the area of his/her expertise, and mentor graduate and undergraduate students. Candidates should demonstrate potential to establish a strong externally-funded research program, publish in peer-reviewed journals, and excel in teaching at the undergraduate and graduate levels. To apply, please visit jobs.wvu.edu and navigate to the position title listed above. Upload (1) a single PDF file containing a curriculum vitae, statement of research interests, statement of teaching philosophy, and names, titles, and full contact information for 3 references; and (2) PDF files of up to 3 publications. In addition, arrange for 3 letters of reference to be sent to Paleobiology@mail.wvu.edu. For additional information, please see pages.geo.wvu.edu/Paleobiology or contact the search chair, Amy Weislogel, at Paleobiology@mail.wvu.edu or (304) 293-6721.

Quantitative Structural Geology or Geomechanics: We seek to hire a full-time (9-month), tenure-track Assistant Professor specializing in quantitative structural geology with interests in the study of fractured reservoirs and geomechanics. The successful candidate will be expected to develop a vigorous externally-funded research program, teach undergraduate classes in structural geology or geomechanics, teach graduate courses in the area of his/her expertise, and mentor graduate and undergraduate students. Candidates should demonstrate potential to establish a strong externally-funded research program, publish in peer-reviewed journals, and excel in teaching at the undergraduate and graduate levels. To apply, please visit jobs.wvu.edu and navigate to the position title listed above. Upload (1) a single PDF file containing a curriculum vitae, statement of research interests, statement of teaching philosophy, and names, titles, and full contact information for 3 references; and (2) PDF files of up to 3 publications. In addition, arrange for 3 letters of reference to be sent to Geomechanics@mail.wvu.edu. For additional information, please see pages.geo.wvu.edu/Geomechanics or contact the search

chair, Dengliang Gao, at Geomechanics@mail.wvu.edu or (304) 293-3310.

Teaching Assistant Professor of Geology: We seek to hire a full-time (9-month), non-tenure track Teaching Assistant Professor. The successful candidate will teach a variety of undergraduate courses, including both large introductory and smaller upper-division classes, in the classroom and online, and the field component of the B.S. capstone course, Geology Field Camp (the last with an additional summer stipend). Specialty area is open. Teaching Assistant Professors at WVU are eligible for promotion; however, promotion to senior ranks is not a requirement for institutional commitment and career stability. This position is a nine-month renewable appointment (no maximum number of terms) and includes full benefits. The position carries an 80% teaching (4 courses per semester) and 20% service assignment. The successful candidate will join a faculty that takes great pride in having members recognized at the university, state, and national levels for excellence in teaching. The Department occupies the recently renovated Brooks Hall with state-of-the-art teaching technologies and facilities. To apply for this position, interested candidates should visit jobs.wvu.edu and navigate to the position title listed above. Upload a single PDF file containing a curriculum vitae, statement of teaching interests and philosophy, teaching evaluations as available, and full contact information for 3 references. In addition, please arrange for three letters of reference to be sent directly to GeologyTAP@mail.wvu.edu. For additional information, please see pages.geo.wvu.edu/GeologyTAP or contact the search chair, Thomas Kammer, at GeologyTAP@mail.wvu.edu or (304) 293-9663.

WVU is an EEO/Affirmative Action Employer and welcomes applications from all qualified individuals, including minorities, females, individuals with disabilities, and veterans. For additional information about the department visit www.geo.wvu.edu.

LECTURER FACULTY POSITION GEOSCIENCE, MIAMI UNIVERSITY

The Dept. of Geology and Environmental Earth Science at Miami University invites applications for a full-time Lecturer faculty position on the Oxford campus, beginning August 2016. The Lecturer will teach undergraduate courses, including foundation courses in physical and environmental geology, as well as intermediate level courses; advise undergraduate students; provide professional service to the department and university. Required: M.S. in geoscience by date of appointment and documented teaching experience. Desired: Ph.D. in geoscience with interest in contributing to supervision of undergraduate student research and field-based experiences. Submit cover letter, vitae, statement of teaching philosophy and experience, unofficial copy of transcripts, and names of three (3) referees to <https://miamioh.hiretouch.com/job-details?jobID=1874>. Letters of reference will be requested upon receipt of application. Inquiries can be directed to Cathy Edwards at edwardca@miamioh.edu. Review of applications will begin on January 15, 2016 and continue until position is filled. Miami University, an EO/AA employer encourages applications from minorities, women, protected

veterans and individuals with disabilities. Miami does not permit, and takes action to prevent, harassment, discrimination and retaliation. Requests for reasonable accommodations for disabilities should be directed to Ms. Mary Jane Leveline at (513) 529-2027. Annual Security and Fire Safety Report may be found at www.MiamiOH.edu/campus-safety/annual-report/index.html. Criminal background check required. All campuses are smoke- and tobacco-free.

FACULTY POSITION, PALEOCLIMATOLOGY AUBURN UNIVERSITY

As part of a larger investment to create a new Climate, Human, and Earth System Sciences (CHESS) Cluster Hire Initiative, the Dept. of Geosciences at Auburn University invites applications for a new tenured/tenure-track Associate or Assistant Professor Position in Paleoclimatology and Energy Systems, beginning in the Fall Semester 2016 (August 16, 2016). Applicants must have a Ph.D. in geosciences or a related field at the time of appointment.

Specialties may include, but are not limited to (1) utilization of key geological (e.g., sediments, tree rings, corals, fossils) and geochemical (e.g., isotope paleoclimate proxies, ice-core greenhouse gas concentrations, etc.) records to investigate the mechanisms and rates of Earth's climate change, (2) modeling the sensitivity of Earth's climate system to changes and uncertainties in natural (e.g., volcanic emissions, methane hydrate stability, etc.) and anthropogenic forcing (e.g., greenhouse gas emissions), (3) connecting past climate of various time scales to the present and predicting future climate, and/or (4) validation of climate and earth system models.

We seek a dynamic individual who will play a leadership role in propelling the Department toward a new intercollegiate Ph.D. program. Collaborative CHESS research programs that are regional or global in scope are currently active with faculty in the College of Sciences and Mathematics, School of Forestry and Wildlife Science, College of Engineering, College of Agriculture, and College of Liberal Arts. The successful candidate is expected to develop a vigorous, externally funded research program, publish scholarly work, and advise graduate and undergraduate students. This individual will also develop and teach a new course in Paleoclimatology and one or more graduate courses based on his/her expertise. The successful candidate for this position will be expected to participate actively in all multidisciplinary Cluster Hire Initiative in the cluster of Climate, Human & Earth Sciences (CHESS). New faculty with expertise in Paleoclimatology and Energy Systems will complement the University's considerable existing expertise in the areas of climate change sciences, geochemistry, sedimentology, hydrology, and petroleum geology to form the core of the innovative Cluster Hire Initiative. Participation in the CHESS initiative will be an important component in faculty annual reviews. For more information regarding the Cluster Hires please visit the following link: www.auburn.edu/academic/provost/strategic_hire.html.

The candidate selected for this position must meet eligibility requirements to work in the United States on the date the appointment is scheduled to

begin (August 2016) and must be able to continue working legally for the proposed term of employment. The candidate must possess excellent written and interpersonal communication skills.

Applications must include curriculum vitae, letter of application describing professional experience, research and teaching interests, copies of transcripts, and the names and contact information of at least three references.

Go apply please go to <http://aufacultypositions.peopleadmin.com/postings/1258>, complete the online form and upload the required application documents.

Applicants are encouraged to visit the AU website to learn more about Auburn University and Geosciences program www.auburn.edu/academic/cosam/geosciences/. Review of applications will begin January 11, 2016 and will continue until a candidate accepts appointment.

Auburn University is an EEO/Vet/Disability employer.

FACULTY POSITION COUPLED NATURAL AND HUMAN SYSTEMS AUBURN UNIVERSITY

The Dept. of Geosciences at Auburn University invites applications for an Assistant Professor Faculty position in Dynamics of Coupled Natural-Human Systems to begin in Fall 2016. We seek a dynamic individual who will play a leadership role in propelling the department toward a new intercollegiate Ph.D. program while helping to build a research program in his/her area of specialization. The candidate for this position will be expected to participate actively in Auburn University's multidisciplinary cluster initiative in the cluster of Climate, Human, and Earth System Sciences (CHESS). The position will complement the university's considerable expertise in this emerging area to form the core of this multidisciplinary initiative. Participation in the CHESS initiative will be an important component in faculty annual reviews. For more information regarding the Cluster Hires please visit the following link: www.auburn.edu/academic/provost/strategic_hire.html. The applicant will be expected to produce nationally recognized research, to secure extramural funding, and to build successful partnerships with industry, government, and other faculty. Desired applicants will have a strong interest in bridging geoscience research with societal needs and in teaching relevant courses at both the undergraduate and graduate level.

The successful candidate must have a strong conceptual and theoretical background in social-economic-ecological systems as well as proven skills in integrated/system approaches and geospatial-statistical modeling that incorporates diverse data analyses at multiple spatial and temporal scales. Focal points for research include modeling and analysis of interactions among climate, ecosystems and human activity from landscape, watershed, and regional to global perspectives. Candidates must have an earned doctorate in geography, environmental science, social science, or a closely aligned field, with a strong publication record and experience working on large, interdisciplinary research projects. The successful candidate will also hold an adjunct professorship in the School of Forestry and Wildlife Sciences. The candidate selected for this

position, which begins August 2016, must meet eligibility requirements to work in the United States on the date the appointment is scheduled to begin and to continue working legally for the term of employment. Excellent written and interpersonal communication skills are required. The successful candidate is expected to develop a vigorous, externally funded research program, publish scholarly work, and advise graduate and undergraduate students.

Applications must include curriculum vitae, letter of application describing professional experience, research and teaching interests, copies of transcripts, and the names and contact information of at least three references. To apply please go to <http://aufacultypositions.peopleadmin.com/postings/1269>, complete the online form and upload the required application documents.

Applicants are encouraged to visit the AU website to learn more about Auburn University and the Dept. of Geosciences (www.auburn.edu/academic/cosam/geosciences/). Review of applications will begin January 11, 2016, and will continue until a candidate accepts appointment.

Auburn University is an EEO/Vet/Disability Employer.

TENURE-TRACK ASSISTANT PROFESSOR HYDROGEOLOGY

CALIFORNIA STATE UNIV. NORTHRIDGE

The Dept. 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 hydrogeology. 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 hydrogeologist with technical expertise in one or more of the following fields: subsurface measurement and modeling of groundwater flow, reactive transport modeling, or remote and/or geophysical sensing of groundwater. Research areas may include, but are not limited to, local and regional-scale groundwater dynamics and groundwater quality; the impact of climate change on groundwater recharge, storage and use; water injection and/or withdrawal and induced seismicity; or groundwater transport of contaminants. We particularly seek candidates who both complement our current research program and integrate across sedimentology, stratigraphy and 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 in a multicultural setting. Potential classes to be taught by the new hire include: a new undergraduate core course in Earth Systems, general education courses in water resources and environmental geology and elective offerings at the upper-division and/or graduate level in the candidate's research specialty.

Applicants should submit a cover letter, CV, the names and full contact information for three references, statement of teaching philosophy and experi-

ence, and statement of research interests. Electronic submissions are strongly encouraged and should be sent to: geology.hydro.search@csun.edu. Materials can also be sent to: Hydro Search Committee, Dept. of Geological Sciences, California State University Northridge, 18111 Nordhoff Street, Northridge, CA 91330-8266. Review of applications will begin 1 January 2016. 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.

SEDIMENTARY GEOLOGY

ASSISTANT PROFESSOR

UNIVERSITY OF NEVADA, LAS VEGAS

The University of Nevada, Las Vegas invites applications for Sedimentary Geology, Assistant Professor (16096). For this tenure track position, preferred research areas include, but are not limited to, sedimentary basin evolution with applications to tectonics or Earth-life-environment interactions across critical transitions in Earth history. We are particularly interested in individuals who integrate field investigations with innovative geochemical, geochronological, or other analytical techniques to pursue interdisciplinary research. The successful candidate is expected to establish a vigorous externally funded research program; teach effectively at both undergraduate and graduate levels including undergraduate field courses; and perform service duties at all levels.

This position requires a Ph.D. in Geology from a regionally accredited college or university by the start of the appointment.

For a position description and application details, please visit <http://jobs.unlv.edu> or call (702) 895-3504.

EEO/AA/Vet/Disability Employer

ASSISTANT PROFESSOR GEOLOGY AND GEOPHYSICS, MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

The Dept. of Geosciences and Geological and Petroleum Engineering invites applications for a full-time tenure-track faculty position in Geology and Geophysics at the Assistant Professor level in petroleum geology with expertise in carbonate reservoirs and basin analysis to begin in August, 2016. Review of applications will begin in November and continue until the search is completed. The successful candidate will be expected to develop an externally-funded research program integrated with excellence in teaching at both the graduate and undergraduate levels with a commitment to interdisciplinary work. Teaching responsibilities will include courses as part of degree requirements as well as in the candidate's area of expertise. The Department currently has 20 full-time faculty, and 371 undergraduate and 309 graduate degree-seeking students with established B.S., M.S., and Ph.D. programs in Geology & Geophysics, Petroleum Engineering, and Geological Engineering. Closely associated departments include Environmental Engineering and Mining Engineering. Local area establishments with active research include the U.S. Geological Survey (Mid-continent Geospatial Mapping Center), Missouri

Dept. of Natural Resources, Fort Leonard Wood, the Missouri S&T Rock Mechanics and Explosives Research Center, Materials Research Center, and Energy Research and Development Center. Interested applicants should submit a cover letter, a current curriculum vitae, a statement of research and teaching interests and experience, and complete contact information for four references electronically to the Missouri University of Science and Technology's Human Resource Office at <http://hr.mst.edu/careers/academic/>. Applicants should ask for Position Number 00031149 to be included on each reference sent directly to the chair of the search committee, Dr. Wan Yang (yangwa@mst.edu). The final candidate is required to provide copies of official transcript(s) for any college degree(s) listed in application materials submitted, prior to the start of employment. In addition, the final candidate may be required to verify other credentials listed in application materials. Failure to do so may result in the withdrawal of the job offer. All job offers are contingent upon successful completion of a criminal background check. The University of Missouri is an equal access, equal opportunity, affirmative action employer that is fully committed to achieving a diverse faculty and staff. Equal Opportunity is and shall be provided for all employees and applicants for employment on the basis of their demonstrated ability and competence without unlawful discrimination on the basis of their race, color, national origin, ancestry, religion, sex, sexual orientation, gender identity, gender expression, age, genetic information, disability, or protected veteran status.

GEOCHEMISTRY LAB MANAGER

MIAMI UNIVERSITY

The Dept. of Geology and Environmental Earth Science at Miami University invites applications for a Geochemistry Lab Manager. The Lab Manager will be expected to manage new trace metal geochemistry and ICP-OES labs, and to share responsibility for ICP-MS, HPLC and powder XRD labs. Duties will include training and supervision of lab users, laboratory maintenance, data quality assurance, assistance in teaching laboratory-based courses, oversight of radiation and environmental health and safety compliance, and laboratory financial management. Laboratory technique development and adaptation for analysis of diverse geologic and environmental materials expected, with opportunities to pursue research and external funding. Required: M.S. or Ph.D. in geology or related field, at least 4 years of experience in major and trace element analysis of geologic materials by plasma techniques at the time of the appointment, and proven experience in successful training and supervision of geochemistry lab users. Desired: experience in powder XRD and HPLC analysis; expertise in laboratory technique development, computer programming and electrical and mechanical abilities. Submit cover letter, vita and unofficial copy of transcripts to: <https://miamioh.hiretouch.com/job-details?jobID=1868>. Arrange to have three (3) letters of recommendation sent to GeochemistrySearch@miamioh.edu. Screening of applications will begin January 15, 2016 and continue until the position is filled. Miami University, an EO/AA employer encourages applications from minorities, women, protected veterans and

individuals with disabilities. Miami does not permit, and takes action to prevent, harassment, discrimination and retaliation. Requests for reasonable accommodations for disabilities should be directed to Ms. Mary Jane Leveline at (513) 529-2027. Annual Security and Fire Safety Report may be found at www.MiamiOH.edu/campus-safety/annual-report/index.html. Criminal background check required. All campuses are smoke- and tobacco-free.

**VISITING INSTRUCTOR
VISITING ASSISTANT PROFESSOR
HYDROGEOLOGY, MIAMI UNIVERSITY**

The Dept. of Geology and Environmental Earth Science at Miami University invites applications for a temporary, full-time faculty position on the Oxford campus, beginning August 2016. This is a nine-month (two academic semester) appointment that may be renewed for up to four years pending funding availability and satisfactory performance. The primary responsibility of this position is teaching, including foundation courses in physical and environmental geology, and intermediate and upper level courses such as Water & Society and Hydrogeology. An M.S. in geology or a related field is required for appointment as Instructor; a Ph.D. is preferred and is required for appointment as a Visiting Assistant Professor. Submit cover letter, vitae, statement of teaching philosophy and experience, unofficial copy of transcripts, and 3 letters to reference to <https://miamioh.hiretouch.com/job-details?jobID=1862>. Inquiries can be directed to Cathy Edwards at edwardca@miamioh.edu. Review of applications will begin on January 15, 2016 and continue until position is filled. Miami University, an EO/AA employer encourages applications from minorities, women, protected veterans and individuals with disabilities. Miami does not permit, and takes action to prevent, harassment, discrimination and retaliation. Requests for reasonable accommodations for disabilities should be directed to Ms. Mary Jane Leveline at (513) 529-2027. Annual Security and Fire Safety Report may be found at www.MiamiOH.edu/campus-safety/annual-report/index.html. Criminal background check required. All campuses are smoke- and tobacco-free.

**FULL PROFESSOR/DEPT. CHAIR
SAN DIEGO STATE UNIVERSITY**

The Dept. of Geological Sciences in the College of Sciences at the San Diego State University seeks outstanding applicants for the position of Department Chair. The preferred start date of the appointment is August 2016. Candidates' particular areas of expertise may be in any of the department's programs. The full advertisement and directions for application are posted at <http://apply.interfolio.com/32049>. For questions or more information please contact Dr. David L. Kimbrough, Search Committee Chair at dkimbrough@mail.sdsu.edu.

**GEOSCIENCE EDUCATION
WESTERN WASHINGTON UNIVERSITY**

Western Washington University invites applications for a tenure-track Assistant Professor starting September 2016, with a joint appointment between the Geology Department and the Science, Math, and Technology Education Program (SMATE). Western

Washington University is a nationally recognized, public, masters-granting institution located in the Pacific Northwest at the base of the North Cascade Mountains. The Geology Department and SMATE Program are committed to WWU's goal of recruiting and retaining diverse faculty, and welcome applications from diverse candidates. The ideal candidate will enhance our existing strengths in geoscience teaching and science teacher preparation. An active research program in geoscience and/or geoscience education is expected. A Ph.D. by hire date is required. Please see the full position announcement for required and preferred qualifications: <https://jobs.wwu.edu/JobPosting.aspx?JPID=6652>. To apply, submit a curriculum vita, undergraduate and graduate transcripts, statements of teaching philosophy and research plans to WWU's Electronic Application System for Employment (linked to electronic job posting). In addition, arrange for three letters of recommendation to be mailed to chris.sutton@wwu.edu or Chris Sutton, Geology Dept., Western Washington University, 516 High Street, Bellingham WA 98225-9080. Questions regarding this position should be directed to the search committee chair, Susan DeBari (susan.debari@wwu.edu). Review of applications begins December 21, 2015; position is open until filled. WWU is an EO/AA employer and encourages applications from women, minorities, persons with disabilities, and veterans.

**TENURE TRACK POSITION
SEDIMENTARY GEOLOGY
DEPARTMENT OF GEOLOGY
APPALACHIAN STATE UNIVERSITY**

The Dept. of Geology at Appalachian State University, Boone, North Carolina, invites applications for a tenure-track faculty position at the level of assistant professor to support the teaching of an intensive, sophomore-level course for majors and environmental science students (Evolution of the Earth), which blends an Earth systems approach with an appreciation of planetary history. The successful applicant should complement the present group of course instructors (a sedimentologist and paleontologist). Additional teaching responsibilities will include an introductory course in historical geology, with other courses possible based on applicant's specialty and student demand.

We seek a sedimentary geologist with research expertise in the broad area of deep time through investigation of the rock record. Potential areas of expertise include (but are not limited to): carbonate sedimentology, stratigraphy, basin analysis, paleoclimate reconstruction, paleontology, geochronology, and/or isotope geochemistry. Candidates are expected to take advantage of the regional geologic setting of the southern Appalachians in their teaching. The successful candidate should have a Ph.D. at the time of appointment and must possess a strong commitment to both undergraduate education and field-based research.

Applications must include a letter of interest, curriculum vita, statements of teaching and research interests, copies of transcripts of all college and university work (official copies due upon employment), and the names and contact information (including e-mail) of three referees familiar with the applicant's teaching and scholarship. Send applica-

tions to Dr. Cynthia Liutkus-Pierce, liutkuscm@appstate.edu. Review of completed applications will begin November 9, 2015 and will continue until the position is filled. Applicants will be notified via email upon receipt of complete applications. Members of the search committee will attend the GSA conference in Baltimore, MD (Nov. 1-3, 2015) and be available to meet with potential candidates through the GeoCareers Interview Service.

The Dept. of Geology at Appalachian State University has 16 faculty members and more than 120 majors. The Dept. and College of Arts and Sciences possess an array of analytical equipment that supports the research of 11 tenure-track faculty. More information about the department is available at our website (geology.appstate.edu). Appalachian State is a comprehensive university located in the Blue Ridge Mountains of western North Carolina and is a member of the University of North Carolina System.

Appalachian State University is an Affirmative Action and Equal Opportunity Employer. The University does not discriminate in access to its educational programs and activities, or with respect to hiring or the terms and conditions of employment, on the basis of race, color, national origin, religion, sex, gender identity and expression, political affiliation, age, disability, veteran status, genetic information or sexual orientation. The University actively promotes diversity among students and employees, is committed to its affirmative action plans, and seeks to deepen its applicant pools by attracting interest from a diverse group of qualified individuals. Individuals with disabilities may request accommodations in the application process by contacting Dr. Liutkus-Pierce at liutkuscm@appstate.edu or 828-262-3049. Any offer of employment to a successful candidate will be conditioned upon the University's receipt of a satisfactory criminal background report. Documentation of identity and employability of the applicant will be required before the hiring process can be finalized.

**TWO POSITIONS
PROFESSOR OF GEOLOGY
GEOLOGY INSTRUCTOR**

**DEPT. OF BIOLOGY AND GEOLOGY
UNIVERSITY OF SOUTH CAROLINA AIKEN**

The Dept. of Biology and Geology at the University of South Carolina Aiken seeks applications for two positions: a full-time, tenure-track Assistant Professor of Geology (Ph.D. required) and a full-time, non-tenure track Geology Instructor. We will consider applications from any field-based area of earth sciences that complements existing departmental strengths. It is expected that one of the hires may have expertise in the Critical Zone. The successful candidates will join a diverse group of scientists with expertise in structural geology, petrology, tectonics, environmental restoration, environmental remediation, and ecology. Primary teaching responsibilities will include undergraduate courses in introductory geology and a specialty area. Start date: August 2016.

Apply online via <http://web.usca.edu/biology/geology-faculty-positions.dot>. A cover letter, resume, teaching philosophy, and a research statement including how undergraduates could be involved

(for assistant professor) are required to be attached to the online application.

Submit undergraduate and graduate transcripts along with three letters of reference to Dr. William Pirkle, Dept. of Biology and Geology, USC Aiken, 471 University Parkway, Aiken SC 29801. Review of applications will begin on October 30, 2015 and continue until position is filled.

Women and minorities are encouraged to apply. USCA is an AA/EOE.

**AQUEOUS AND ENVIRONMENTAL
GEOCHEMISTRY POSITION
UNIVERSITY OF MASSACHUSETTS**

The Dept. of Geosciences at the University of Massachusetts invites applications for a tenure track position in Aqueous and Environmental Geochemistry at the Assistant Professor level starting Fall 2016. We are seeking talented applicants qualified for an assistant professor position. Under exceptional circumstances, highly qualified candidates at other ranks may receive consideration.

A Ph.D. in Geosciences or related field is required at the time of appointment and post-doctoral experience is preferred.

The successful candidate will have research interests within the broad area covered by the position title. These areas might include critical zone and near-surface weathering, processes that occur at solid-water interface, including biological interactions, or chemical, physical and biological processes controlling the transport of dissolved species. It is hoped that the candidate will have interests in isotope or trace element geochemistry and the application of geochemical tools to a broad range of scientific questions.

Research within the Dept. of Geosciences revolves around four main clusters: Global Change and Surface Processes; Water; Dynamic Earth; and Geography, Society and the Environment. It is expected that successful candidate will develop a rigorous externally funded research program and contribute to one or more of these research themes. Candidates who have experience in integrating geochemical tools with quantitative approaches to solving problems in natural systems are especially encouraged. Field-oriented research that could be incorporated into both undergraduate and graduate courses will be an asset. Teaching will involve participation in a large-enrollment introductory course in addition to appropriate advanced undergraduate and graduate courses.

Applicants must submit a cover letter, CV, research statement, teaching statement, and contact information for three referees familiar with their research and teaching efforts to: <http://umass.interviewexchange.com/jobofferdetails.jsp?JOBID=64033>. For more information, visit the Dept. of Geosciences website (www.geo.umass.edu) or contact the Search Committee Chair (search@geo.umass.edu). Review of applicants will begin 16 November 2015 and continue until the ideal candidate is identified.

The university is committed to active recruitment of a diverse faculty and student body. The University of Massachusetts Amherst is an Affirmative Action/Equal Opportunity Employer of women, minorities, protected veterans, and individuals with disabilities

and encourages applications from these and other protected group members. Because broad diversity is essential to an inclusive climate and critical to the University's goals of achieving excellence in all areas, we will holistically assess the many qualifications of each applicant and favorably consider an individual's record working with students and colleagues with broadly diverse perspectives, experiences, and backgrounds in educational, research or other work activities. We will also favorably consider experience overcoming or helping others overcome barriers to an academic degree and career.

**AFFILIATE FACULTY OF GEOLOGY
GRAND VALLEY STATE UNIVERSITY**

The Geology Dept. at Grand Valley State University invites applications for a non-tenure-track Affiliate faculty position to begin in the Fall 2016. For more information about the responsibilities of the position, please visit <https://www.gvsujobs.org>. A minimum of a M.S. in Geosciences with teaching experience is required.

Apply online at www.gvsujobs.org. Attach a letter of application, vitae, statement of teaching philosophy and the names and contact information of at least three references familiar with your teaching. Review of applications to begin December 15, 2015 and continue until the position is filled. Contact Peter Riemersma (riemersp@gvsu.edu) with any questions. The Geology department website may be found at www.gvsu.edu/geology. Grand Valley is an affirmative action, equal opportunity institution.

**ASSISTANT PROFESSOR
ECONOMIC GEOLOGY/MINERALOGY
SOUTHERN ILLINOIS UNIV. CARBONDALE**

The Dept. of Geology at Southern Illinois University Carbondale invites applications for a tenure-track position in economic geology/mineralogy at the assistant professor level, starting August 16, 2016, contingent upon available funding. More information, including qualifications and how to apply is available at <http://affact.siu.edu/faculty.php> (Search COS-351). Application deadline: January 4, 2016 or until filled. SIU Carbondale is an Affirmative Action/Equal Opportunity employer of individuals with disabilities and protected veterans that strives to enhance its ability to develop a diverse faculty and staff and to increase its potential to serve a diverse student population. All applications are welcomed and encouraged and will receive consideration.

**TENURE-TRACK
ASSISTANT OR ASSOCIATE PROFESSOR
ECONOMIC GEOLOGY
UNIV. OF NEVADA LAS VEGAS**

The successful applicant will have an active research program that includes a field component that complements existing departmental strengths, and will have a strong commitment to teaching at both graduate and undergraduate levels. The candidate is expected to investigate scientific questions related to economic geology, mineral resources, and/or fluid-rock interaction; to develop new experimental or analytical techniques for ore deposit exploration and genesis; and to communicate results internationally. The candidate is also expected to develop (Assistant), or show evidence for (Associate) a rigorous

externally-funded research program and to supervise MS and Ph.D. students. Preference will be given to applicants with research interests in one or more subdisciplines including high temperature and/or isotope geochemistry, geochemical modeling, experimental petrology, and/or geochronology as they relate to ore deposit genesis. The UNLV Geoscience department has 21 Faculty, more than 50 MS/Ph.D. students, and hosts laboratory facilities including stable isotope, argon geochronology, fluid inclusions, XRF/XRD, ICP-MS, soils, and electron microprobe/SEM labs. Materials should be addressed to Dr. Matthew Lachniet, Search Committee Chair, and are to be submitted via on-line application at <https://hrsearch.unlv.edu>. Review of application materials will begin on 12/11/15 and continue until filled. UNLV is an Affirmative Action / Equal Opportunity educator and employer committed to excellence through diversity.

**FACULTY POSITION
PLANETARY PETROLOGY/
MINERALOGY/GEOCHEMISTRY**

UNIVERSITY OF TENNESSEE, KNOXVILLE

The Dept. of Earth & Planetary Sciences at The University of Tennessee seeks to fill a faculty position in petrology/mineralogy/geochemistry with emphasis in planetary geoscience. The position is for an open-rank (tenure-track or tenured); we would prefer to select a candidate at the Associate or Full Professor level, but welcome applications for Assistant Professor. The position begins August 1, 2016. The University of Tennessee, Knoxville is a Research I University and the flagship campus of the UT system. The Dept. (<http://eps.utk.edu>) focuses on geology and has an active emphasis on planetary research through its Planetary Geosciences Institute (<http://web.utk.edu/~pgi>). Requirements for the position are: Ph.D. in geology or a related field, and demonstrated research experience in planetary geoscience.

The successful candidate is expected to conduct a robust, funded program of planetary research, mentor graduate students, effectively teach courses in petrology and/or mineralogy at the undergraduate and graduate levels, and collaborate in department research dealing with petrology, mineralogy, geochemistry, and solar system exploration. Salary and benefits are competitive and commensurate with experience. The Knoxville campus of the University of Tennessee is seeking candidates who have the ability to contribute in meaningful ways to the diversity and intercultural goals of the University.

To apply, please email the following to mcsween@utk.edu: C.V., cover letter describing research and teaching experience and plans, and names of 4 references with contact information. Applications received by December 15, 2015 are ensured review, but earlier submission is encouraged. The position will remain open until filled. Questions about the position should be directed to H. McSween.

The University of Tennessee is an EEO/AA/Title VI/Section 504/ADA/ADEA institution in the provision of its education and employment programs and services. All qualified applicants will receive equal consideration for employment without regard to race, color, national origin, religion, sex, pregnancy, marital status, sexual orien-

tation, gender identity, age, physical or mental disability, or covered veteran status.

SURFICIAL GEOLOGY MINOT STATE UNIVERSITY

The Dept. of Geosciences at Minot State University invites applications for a tenure-track faculty position in surficial geology. The appointment will be at the assistant professor level starting fall 2016. A Ph.D. in geological sciences or related field by time of appointment is expected. We seek someone with a broad, field-based background in surficial processes. Teaching expectations include: upper-level courses in geomorphology and soils; introductory GIS; and contribution to introductory geology courses. Applicants should demonstrate potential for excellence in undergraduate teaching and engagement in research that would involve undergraduate students. Applicants should send a faculty employment application form (found at www.minotstateu.edu/hr/pdf/msu_faculty_app.pdf), cover letter, CV, copies of transcripts, statement of research interests, and statement of teaching interests/philosophy to: Dr. John Webster, Search Committee Chair (send electronically to john.webster@minotstateu.edu). Applicants should arrange to have three letters of reference sent directly to the search committee. Review of applications will begin on November 15, 2015, and will continue until the position is filled. Minot State University is an affirmative action/equal opportunity and veterans preference employer

W.B. HAMILTON PROFESSOR OF EARTH SCIENCES SOUTHERN METHODIST UNIVERSITY

Position No. 06029. The Roy M. Huffington Dept. of Earth Sciences at SMU announces a search to fill a named tenure-track or tenured professorship (the rank is open) honoring WB Hamilton. We solicit nominations and applications from earth scientists who maintain vigorous and sustainable research programs and who have a commitment to full participation in the educational mission of the department to provide professional training in a liberal arts environment. As the fourth holder of the chair established in 1921, the successful candidate will extend existing departmental strengths in earth science. The department's focus is on pure research to understand Earth history and geologic processes with applied research on problems in the national interest such as climate and environmental change, earthquake seismology including induced seismicity, natural hazards, nuclear test ban monitoring and resources including geothermal energy. The expected start date is August 1, 2016.

Applications can be submitted electronically to sschwob@smu.edu or in writing to: Professor John Walther, Search Committee Chair, Dept. of Earth Sciences, Southern Methodist University, P.O. Box 0395, Dallas TX 75275.

Applicants should include curriculum vitae, statements of research and teaching interests, and contact information for three references. To insure full consideration applications must be received by December 5, 2015, but the committee will continue to accept applications until the position is filled. The committee will notify applicants of its employment decisions after the position is filled.

Southern Methodist University will not discrimi-

nate in any program or activity on the basis of race, color, religion, national origin, sex, age, disability, genetic information, veteran status, sexual orientation, or gender identity and expression. The Executive Director for Access and Equity/Title IX Coordinator is designated to handle inquiries regarding nondiscrimination policies and may be reached at the Perkins Administration Building, Room 204, 6425 Boaz Lane, Dallas, TX 75205, 214-768-3601, accessequity@smu.edu.

Hiring is contingent upon the satisfactory completion of a background check.

ASSISTANT PROFESSOR, GEOPHYSICS CALIFORNIA STATE UNIV. LONG BEACH

The Dept. of Geological Sciences invites applications for a tenure track faculty position in Geophysics at the rank of Assistant Professor to begin in August 2016. Teaching duties include Geophysics and related subjects at undergraduate and graduate (M.S. degree) levels. The area of research should be in applied, shallow-earth geophysics using seismic reflection and other remote sensing techniques. Qualifications include demonstrated commitment to working successfully with a diverse student population and demonstrated potential for developing and sustaining an independent, externally funded research program involving students. The full position description and application requirements are available at web.csulb.edu/divisions/aa/personnel/jobs/posting/2316/index.html. Review of applications to begin December 4, 2015.

JUNIOR LEVEL FACULTY POSITION SEDIMENTARY BASIN ANALYSIS DEPT. OF MARINE, EARTH, AND ATMOSPHERIC SCIENCES

NORTH CAROLINA STATE UNIVERSITY

The Dept. of Marine, Earth, and Atmospheric Sciences (MEAS) at North Carolina State University (NC State) intends to fill a junior (Assistant / Associate Professor) tenure-track faculty position in **sedimentary basin analysis**. Possible research areas include, but are not limited to, the relationship of basin evolution to mantle processes, linkages of stratigraphy to landscape evolution as a function of tectonics, climate, and sea-level change, the prediction of sub-surface porosity and permeability to model the movement of water and hydrocarbons, and the use of stratigraphy in paleo-environmental and paleo-biological studies. The starting date for this position is 15 August 2016. Candidates that combine surface and/or subsurface observations with numerical simulations, analogue models, or laboratory experiments to investigate the geologic history of sedimentary basins are preferred, and applicants should have a strong interest in interdisciplinary collaborations across and beyond the geosciences.

Applicants must hold a Ph.D. degree in the geosciences or a related field. Postdoctoral experience is preferred, but not required. The successful candidate must demonstrate strong potential for outstanding accomplishments in research, research supervision, and teaching. The successful applicant will be expected to teach an undergraduate-level course in stratigraphy, as well as other undergraduate and graduate classes commensurate with the candidate's interest and expertise. An interest in

participating in the Department's capstone undergraduate geology field course also is desirable. MEAS places a high value on excellent instruction and the use of innovative teaching methods.

Affiliated with the College of Sciences at NC State, MEAS is one of the largest interdisciplinary geoscience departments in the nation. Opportunities exist for disciplinary and interdisciplinary interactions with more than 30 marine, earth, and atmospheric scientists. Additional information about the department and its facilities can be found on the web page: www.meas.ncsu.edu.

Review of applications will begin on 15 November 2015; the position will remain open until filled. Applications, including cover letters, curriculum vitae, teaching and research statements, and contact information for three references must be submitted online at <https://jobs.ncsu.edu/>. Please search for position number **00001300**.

Founded in 1887, NC State is a land-grant institution distinguished by its exceptional quality of research, teaching, extension, and public service. Located in Raleigh, North Carolina, NC State is the largest university in North Carolina, with more than 34,000 students and 8,000 faculty and staff. National rankings consistently rate Raleigh and its surrounding region among the five best places in the country to live and work, with a highly educated workforce, moderate weather, reasonable cost of living, and a welcoming environment. A collaborative, supportive environment for business and innovation and research collaborations with area universities and the Research Triangle Park are compelling reasons for relocation to the area. NC State is an equal opportunity and affirmative action employer. All qualified applicants will receive consideration for employment without regard to race, color, national origin, religion, sex, sexual orientation, age, veteran status, or disability. Applications from women, minorities, and persons with disabilities are encouraged.

TENURE-TRACK POSITION IN SEDIMENTOLOGY OR GEOPHYSICS TEXAS TECH UNIVERSITY

The Dept. of Geosciences at Texas Tech University seeks applicants for a tenure-track, assistant professor position in either sedimentology or geophysics to start Fall 2016. A Ph.D. in an Earth Science or closely related discipline at time of appointment is required.

We seek a dynamic researcher and teacher who uses innovative field, laboratory and/or modeling approaches in either targeted area. For sedimentology, we seek candidates with expertise in sandstone, mudstone or carbonate sedimentary systems. For geophysics, we seek candidates with a specialty in seismology or CSEM/MT methods. The geophysics candidate's main area of research should be in imaging and interpreting crust and lithospheric features and whose interests include the basin scale. A letter of application including contact information for three references, vita, and short statements of research and teaching philosophies can be uploaded at www.texas-tech.edu/careers/requisition#5155BR.

We seek candidates with strong records of scholarship who have the proven capacity or the clear potential to bring externally sponsored research to Texas Tech University. The department ([GSA TODAY | \[www.geosociety.org/classads\]\(http://www.geosociety.org/classads\)](http://www</p></div><div data-bbox=)

.geosciences.ttu.edu) has active research specialties in geology, geophysics, geochemistry, geography, and atmospheric science. We have ~400 undergraduate majors and ~85 graduate students. Texas Tech is located in Lubbock on the edge of the Permian Basin. The region appreciates the social and economic importance of geoscience research due to the importance of petroleum and groundwater resources to the national economy. Teaching duties include graduate and undergraduate courses in the candidate's specialty. Service to the department, university, and discipline is expected.

As an Equal Employment Opportunity/Affirmative Action employer, Texas Tech University is dedicated to the goal of building a culturally diverse faculty committed to teaching and working in a multicultural environment. We encourage applications from qualified candidates who can contribute, through research, teaching, and service, to the diversity and excellence of the academic community at Texas Tech University. The university welcomes applications from minorities, women, veterans, persons with disabilities, and dual-career couples. Evaluation of candidates will begin November 11, 2015 and continue until the position is filled. Dept. representatives will be available to discuss the position at the GSA Annual Meeting (1-4 November) in Baltimore, Maryland. Questions should be sent to Dr. Jeff Lee, Search Committee Chair: jeff.lee@ttu.edu.

**ASSISTANT PROFESSOR OF GEOLOGY
(SURFICIAL GEOLOGY)
NORTHLAND COLLEGE, ASHLAND,
WISCONSIN**

Northland College is seeking a dedicated educator for a tenure-track Assistant Professor position in the general area of surficial geology. The successful candidate will teach six courses per year, including Physical Geology, Landforms, Hydrology, Senior Capstone Research/Senior Seminar, and two other courses, one of which will be a field or other intensive experiential course during the College's May Term. A Ph.D. in geology is required (conferred by August, 2016). Review of applications will begin on December 1, 2015, and the position will begin in late August, 2016. For more information go to www.northland.edu/jobs.

**EARTH SURFACE PROCESSES
DARTMOUTH COLLEGE**

The Dept. of Earth Sciences at Dartmouth College invites applications for a junior rank tenure-track position in the general area of Earth Surface Processes. We especially welcome applications from candidates with research interests in the generation, transport and deposition of sediments and related contaminants in hill slope and stream channel environments, potentially with additional research interests in the biological mediation of physical processes and forms. 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 Dept. of Biological Sciences, Dept. of Geography, and the 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 Dept. 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 Dept. 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: <http://apply.interfolio.com/30984>

Applications received by November 11, 2015, will receive first consideration. The appointment will be effective July 1, 2016.

With an even distribution of male and female students and over a quarter of the undergraduate student population members of minority groups, Dartmouth is committed to diversity and encourages applications from women and minorities. Dartmouth College is an equal opportunity and affirmative action employer.

**TENURE-TRACK APPLIED GEOSCIENCE
BAYLOR UNIVERSITY**

Baylor University is a private Christian university and a nationally ranked research institution, consistently listed with highest honors among The Chronicle of Higher Education's "Great Colleges to Work For." Chartered in 1845 by the Republic of Texas through the efforts of Baptist pioneers, Baylor is the oldest continuously operating university in Texas. The university provides a vibrant campus community for over 15,000 students from all 50 states and more than 80 countries by blending interdisciplinary research with an international reputation for educational excellence and a faculty commitment to teaching and scholarship. Baylor is actively recruiting new faculty with a strong commitment to the classroom and an equally strong commitment to discovering new knowledge as we pursue our bold vision, Pro Futuris.

Baylor seeks to fill the following tenure-track Assistant Professor faculty position within the Dept. of Geology with specialization in Geophysics, Stratigraphy or Structural Geology, beginning in August 2016. Candidates should possess an earned doctorate in geophysics or geology at the time of appointment. Preference will be given to a candidate with a strong background in pure or applied research who works with subsurface data (e.g., seismic, potential field,

well log, rock property, fluid production, or combinations of these data types). The successful candidate should have the potential to attract external funds and to build a strong research program that involves both undergraduate and graduate (M.S. and Ph.D.) students. We seek an individual with a strong commitment to excellence in teaching at the graduate and undergraduate levels.

Application Process: Send letter of interest, including statement of teaching and research interests, curriculum vitae, official transcripts, and the names and contact information for three references to: Dr. Jay Pulliam, Chair, Search Committee, Dept. of Geology, Baylor University, One Bear Place #97354, Waco, TX 76798-7354 (Tel: 254-710-2361; e-mail: appliedgeosci2016@baylor.edu). Applications will be reviewed beginning in September 2015 and applications will be accepted until the position is filled.

Baylor University is a private not-for-profit university affiliated with the Baptist General Convention of Texas. As an Affirmative Action/Equal Opportunity employer, Baylor is committed to compliance with all applicable anti-discrimination laws, including those regarding age, race, color, sex, national origin, marital status, pregnancy status, military service, genetic information, and disability. As a religious educational institution, Baylor is lawfully permitted to consider an applicant's religion as a selection criterion. Baylor encourages women, minorities, veterans and individuals with disabilities to apply.

**STRUCTURAL GEOLOGIST
TENURE-TRACK FACULTY POSITION
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The Dept. of Geological Sciences at California State University Fullerton (<http://geology.fullerton.edu/>) invites applications for an Assistant Professor position in Structural Geology beginning August 2016. The successful candidate will: (1) be expected to develop active, field-based, externally funded research programs involving undergraduate and Master's level graduate students; (2) be committed to excellence in teaching at the undergraduate and Master's levels; and (3) have the ability to communicate effectively with an ethnically and culturally diverse campus community. She/he must display evidence of a field-based research program in structural geology. Primary teaching responsibilities will be structural geology, geologic field methods, and field camp. The successful candidate may also teach introductory-level and upper-level/graduate courses in the candidate's area of specialization. For a complete position description, information on the CSUF Dept. of Geological Sciences, and application procedures, see: http://hr.fullerton.edu/diversity/job-openings/ft/8082BR_structural_geologist.asp


Applications will be accepted until the position is filled. To ensure full consideration, submit all application materials by November 16, 2015. 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. EEO employer.

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Applications should include a statement of teaching and research interests in the context of a liberal arts college. Candidates should specifically address their ability to 1) teach in a socioeconomically, ethnically and culturally diverse environment, and 2) engage students in an ongoing research program. Submit statement, curriculum vitae, 1-3 significant publications, and contact information for three referees to Dr. Margi Rusmore, Search Committee Chair, at geosearch1@oxy.edu. Members of underrepresented groups are especially encouraged to apply. Review of applications will begin October 15, 2015, and will continue until the search closes on December 22, 2015. **Search committee members will meet interested candidates at the GSA and AGU meetings; email the committee to make arrangements.**

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Review of applications will begin Oct. 15 and continue until the position is filled. SFA is an equal opportunity employer. This is a security-sensitive position and will be subject to a criminal history check.



We need to talk: Facilitating communication between field-based geoscience and cyberinfrastructure communities

Matty Mookerjee*, **Daniel Vieira**, *Dept. of Geology, Sonoma State University, Rohnert Park, California 94928, USA*; **Marjorie A. Chan**, *Dept. of Geology & Geophysics, The University of Utah, Salt Lake City, Utah 84112, USA*; **Yolanda Gil**, *Information Sciences Institute, University of Southern California, Marina del Rey, California 90292, USA*; **Charles Goodwin**, *Dept. of Applied Linguistics, University of California at Los Angeles, Los Angeles, California 90095, USA*; **Thomas F. Shipley**, *Dept. of Psychology, Temple University, Philadelphia, Pennsylvania 19122, USA*; and **Basil Tikoff**, *Dept. of Geoscience, University of Wisconsin–Madison, Madison, Wisconsin 53706, USA*

A UNIQUE OPPORTUNITY FOR CYBERINFRASTRUCTURE

It is increasingly important to integrate datasets and models from multiple geoscience subdisciplines in order to significantly advance our knowledge of how the planet works. To facilitate interdisciplinary investigations, geoscientists need a cyberinfrastructure that will easily access and combine datasets from all of the current and future geo-community databases. To this end, NSF introduced the EarthCube initiative (www.earthcube.org) to “create a community-driven data and knowledge management system that will allow for unprecedented data sharing across the geosciences.” The ultimate goal of EarthCube is to transform Earth science investigations by promoting efficient data access, incorporating cyberinfrastructure into our scientific workflow, and allowing for increased sophistication of analyses and models (Gil et al., 2014; Kelbert, 2014; Richard et al., 2014). A significant strength of EarthCube is its potential to create sustained communication across the subfields within the Earth sciences, allowing scientists to ask new types of questions, and providing the means to address previously unanswerable ones. Examples of specific use cases are available on the EarthCube webpage; however, using machine learning to extract data from published articles (e.g., DeepDive [<http://deepdive.stanford.edu>]) and curating useful software/scripts (e.g., GeoSoft [<http://www.isi.edu/ikcap/geosoft/>]) are two widely applicable examples of EarthCube outcomes.

While the technical issues of interconnecting all existing community databases are significant challenges, an even more fundamental issue needs to be addressed: Not all communities have a database or the institutional support to manage one. In order for EarthCube to be successful, data from all subdisciplines need to be represented in the data management system. In

particular, the field-based geosciences have lagged behind other subdisciplines with respect to developing a cyberinfrastructure for their datasets. This is likely due to the fact that most field data is collected and recorded in an analog format (e.g., Brunton compass, field notebook, and sketches) and through various personalized conventions. The additional step of digitizing these data is often onerous. In order to facilitate the development of cyberinfrastructure for the field-based geosciences, digitization processes must be incorporated into the typical geoscience workflow in a way that is as unobtrusive as possible (e.g., digital field notebooks, digital compasses, voice recognition software, digital pens, etc.). These potential solutions need to be developed in tandem with the cyberinfrastructure for managing these datasets. This is why it is critical to get the cyberinfrastructure and the field-based geoscience communities together and communicating effectively. Field-based geoscientists need the cyberinfrastructure community to advise them on the efficient collection of data for optimal digitization, while keeping them grounded in what is technically feasible. The geoscience community must engage and communicate their current and anticipated needs along with their specific data formats and requirements in order to design an effective data management system.

BRINGING CYBERINFRASTRUCTURE RESEARCHERS INTO THE FIELD

In order to facilitate the necessary communication between field-based geoscience and cyberinfrastructure communities, we proposed the currently funded NSF EarthCube project: “(EC3) Earth-centered communication for cyberinfrastructure: Challenges of field data collection, management and integration.” With this project, we brought together various field-based geologists with computer scientists and a cognitive psychologist in a field setting. In August of 2014, 32 field-trip participants (12 computer scientists, 10 geoscientists, four graduate students, three undergraduates, two applied linguists, and one cognitive scientist) traveled to Yosemite and Owens Valley, California, USA, in order to discuss cyberinfrastructure-related issues. There is no better place to gain an appreciation for the field geologist’s workflow than in the field itself. For the same reasons that we bring students into the field to explain fundamental concepts in the Earth sciences, the field provides an excellent venue for engaging with computer scientists about the multiple scales and interconnections of geological data, data collection strategies and techniques,

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and data representation. This field trip allowed these communities to understand each other's goals; geoscientists explained their data needs, while cyberinfrastructure experts explained the challenges associated with the current technology and data tools. Moreover, by presenting the results of data collected from the specific field areas that we visited, the computer scientists were able to gain an appreciation for the scope of scientific questions that geologists try to answer, the role of data in making geological inferences, the decision-making process for collecting future datasets, and how data and models interact in developing a regional conceptual framework. Sharing experiences in the field, both intellectual and practical, is a time-tested method for creating a strong and collaborative scientific community.

SURVEY OF FIELD-TRIP PARTICIPANTS

Approximately three weeks prior to attending the 2014 EC3 field trip, the participants were asked to complete a voluntary, 55-question survey in order to assess their current understanding, interest, and experience with cyberinfrastructure in the geosciences as well as their knowledge and level of involvement in EarthCube. Of the 32 field trip participants, we received 25 responses to the pre-field trip survey. Directly after the completion of the field trip, the participants were again asked to complete the same survey along with an additional 15 questions. The post-field trip survey garnered 28 responses. The goal of these two surveys was to evaluate the effectiveness of using field experiences to help identify and bridge the conceptual gaps between the geoscience and cyberinfrastructure communities with respect to developing the appropriate data infrastructure for the field-based geosciences.

We highlight here the most salient results from these surveys, summarized in Figure 1. The complete survey and partially redacted results can be downloaded from this link: http://www.sonoma.edu/users/m/mookerje/EC3_pre&post_survey_Redacted.pdf. The data suggest that after the field trip, both geologists and computer scientists felt that they had a better understanding about the current challenges facing field geoscientists with respect to getting their data fully incorporated into the appropriate data infrastructure. Similarly, both groups also had a better understanding of what was needed by the cyberinfrastructure community in order to design an effective integrated data system. Computer scientists gained a more complete idea of how they could help geoscientists capture their data into a data

management system, and they were confident that it was possible to fully capture the types of data used by field geologists into an integrated data system. It is unsurprising that this increase correlates with an increase in the computer scientists' understanding of what geologists do in the field. After the field trip, both the geoscientists and the cyberinfrastructure participants responded that they were more likely to utilize EarthCube resources in their own research and that they believed that the development of cyberinfrastructure would ultimately save them time in their various scientific endeavors.

THE PATH FORWARD

For EarthCube to succeed, it needs to engage the larger geoscience population and build consensus around what cyberinfrastructure is the most appropriate for our community. Activities designed to communicate across disciplinary lines—such as the field trips described here—are an effective approach. However, we also need mechanisms that scale in such a way as to incorporate input from a larger percentage of our scientific community. From our perspective, almost every geologist that we talk with recognizes the need for cyberinfrastructure. It is clear that we must have digital data systems in order to increase the capacity and efficiency for conducting science, improving the quality of science, and facilitating new discoveries. Further, there is increasing pressure from funding agencies that we make our data more widely available. Regardless of this pressing need, many of the geoscientists we have talked to seem to be taking a “wait and see” attitude toward cyberinfrastructure and EarthCube specifically. While that reluctance is, to some extent, understandable, cyberinfrastructure cannot be designed well without input from the communities that it is meant to serve. We are now at a critical junction to make field-based geologic data an integral part of EarthCube. This task will be difficult and will take time away from other activities, but it is essential to the future of the science. We urge all geoscientists—especially early-career investigators and graduate students, who will inevitably take advantage of these systems during their careers—to engage and help shape the emerging geological cyberinfrastructure (<http://earthcube.org/info/get-involved>). One excellent venue for learning more about ongoing and planning activities is at EarthCube Town Hall meetings hosted at the national GSA and AGU conferences. However one decides to engage, now is the time for geoscientists to make their opinions, perspectives, and data needs known.

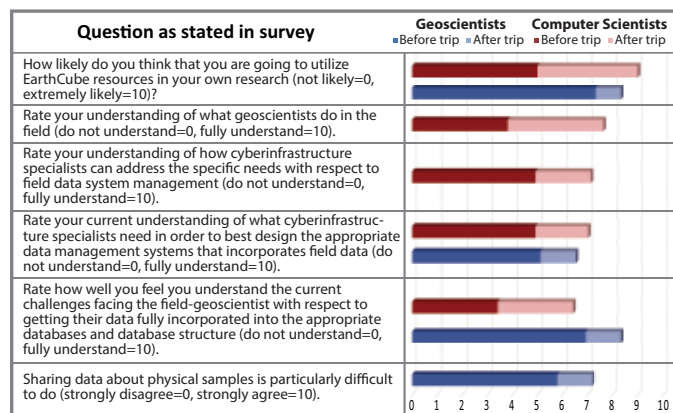


Figure 1. 2014 EC3 Field Trip Pre- and Post-Survey Results.

ACKNOWLEDGMENTS

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Manuscript received 27 Feb. 2015; accepted 9 June 2015. ★

2016 GSA Section Meetings

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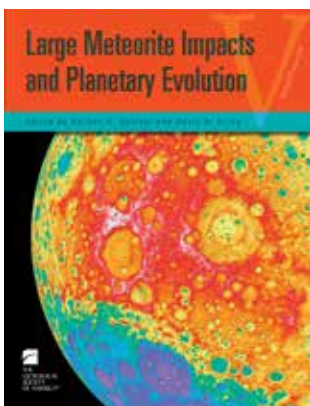
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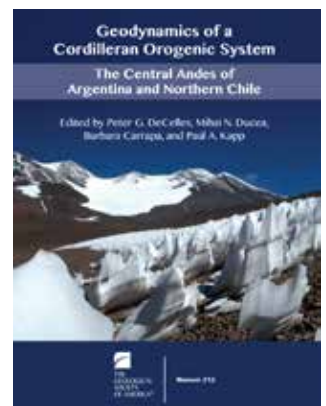
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Questions? Please contact Lindsey Henslee, +1-303-357-1006, lhenslee@geosociety.org.

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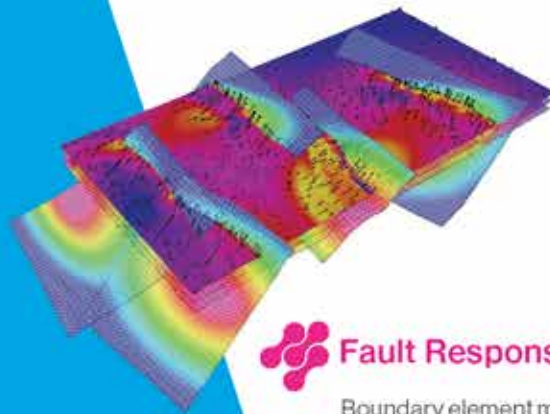
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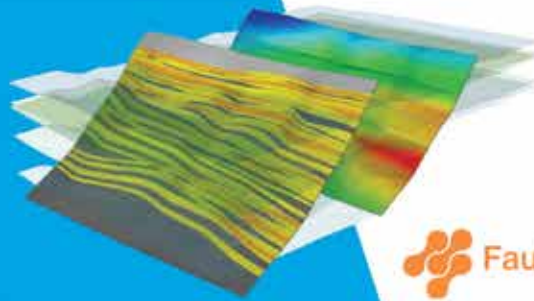
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