GSA Today: Twenty Years and Counting, p. 10

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Alternative Perspectives of Crustal and Upper Mantle Phenomena Along the Rio Grande Rift

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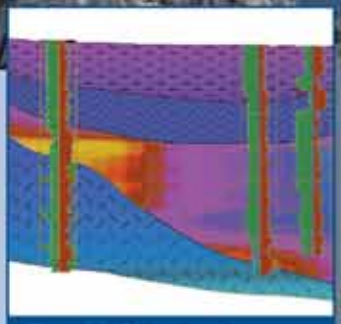

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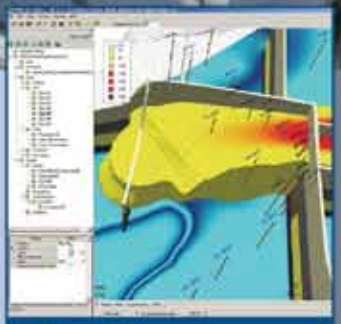

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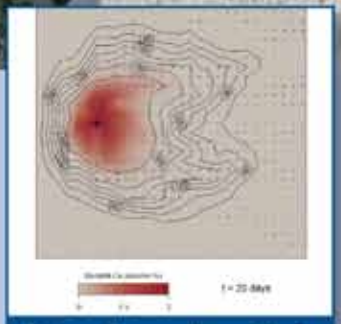

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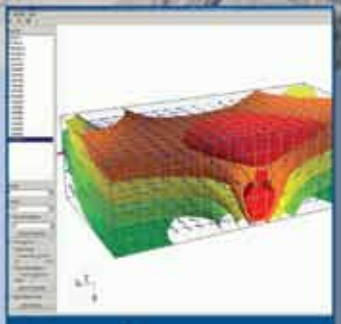

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SCIENCE ARTICLE

Cover: Elevation and relief map of New Mexico, USA, showing the Rio Grande, which flows southward along the axis of the slowly extending Rio Grande rift. Regional heat flow data and foreshortened seismic velocity profiles suggest that upward mantle advection is focused along the western boundary of thick lithosphere under the Great Plains province near the eastern margin of the Rio Grande rift. Digital cartography by Lewis Gillard, New Mexico Bureau of Geology and Mineral Resources, New Mexico Tech. See "Alternative perspectives of crustal and upper mantle phenomena along the Rio Grande rift," by M. Reiter and R.M. Chamberlin, p. 4–9.

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Alternative perspectives of crustal and upper mantle phenomena along the Rio Grande rift

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ABSTRACT

At various locations along the Rio Grande rift in central and southern New Mexico, USA, heat flow data suggest a rather abrupt change from high values often associated with the rift to lower values characterizing neighboring geologic provinces. With this consideration in mind, we explore possible perspectives derived from seismic cross sections along La Ristra profile crossing New Mexico. In New Mexico, La Ristra transects at ~45° to the generally accepted north-south axis of the Rio Grande rift and more acutely to potential eastern boundaries of the southern rift. Considering foreshortened projections of seismic cross sections, one may be able to better visualize possible advection associated with the Rio Grande rift, although resolution of existing seismic data suggests the narrow, near vertical seismic anomalies in these projections may be hypothetical interpretations. If the foreshortened cross sections are realistic, then upper-mantle upwelling appears to be focused near the Rio Grande rift–Great Plains craton boundary.

INTRODUCTION

"Ristra is a deep-imaging seismic experiment using naturally-occurring earthquake sources" (RISTRA Research Group, 2007). Analysis of seismic data along the La Ristra profile has provided extremely valuable information regarding the seismic velocity distribution in the crust and upper mantle from southeastern New Mexico and west Texas to northeastern Arizona, USA (Fig. 1) (Gao et al., 2004; West et al., 2004; Wilson et al., 2005b). These analyses have been related to phenomena typically associated with rift tectonics, such as mantle convection and elevated temperature and partial melting conditions in the crust and upper mantle. Several considerations with respect to the resulting seismic cross sections and the relationship to the traversed geological provinces are noted (Fig. 1): (1) the seismic profile is oriented at ~45° to the generally accepted north-south axis of the Rio Grande rift; (2) south of the Albuquerque Basin, the Rio Grande rift widens considerably into east-stepping basins, including the Oscura Basin and Tularosa Basin in New Mexico and, from geomorphic studies, the Salt Basin extending into Texas; (3) the distance from La Ristra to possible eastern edges of the Rio Grande rift likely increases south of Socorro; and (4) the seismic cross sections represent a swath average of up to ~160 km on either side of La Ristra. These observations suggest that subsurface seismic changes may be unduly smoothed and broadened along La Ristra south of the intersection with the Rio Grande rift in the southern Albuquerque Basin (Fig. 1).

Relative *Vs* seismic cross sections show quite distinctly the extent and magnitude of anomalous seismic regions in the crust and upper mantle referenced to a standard model (*Vs* is shear wave velocity; relative *Vs* is $\Delta Vs/Vs\%$, referenced to 1-D standard model AK135 in the mantle and laterally averaged structure in the crust; West et al., 2004; Fig. 2). Negative relative *Vs* indicates slower velocities (warmer material and/or more fluids); positive *Vs* implies faster velocities (cooler, more dense material). We combine and modify these crust and upper mantle relative *Vs* cross sections so that horizontal and vertical scales are the same and then show four different projections of the cross sections (Figs. 2A–2D). The first projection is along La Ristra; the second is normal to the north-south axis of the rift (Figs. 2A and 2B; after West et al., 2004, and Wilson et al., 2005b, respectively). The last two projections are normal to lines that approximate possible eastern boundaries of the rift southeast of Socorro (Figs. 2C and 2D); these projections imply that the thermal and structural anomalies associated with the Rio Grande rift begin near the rift boundary, although the boundary in some locations may be elusive.

BRIEF GEOLOGICAL BACKGROUND OF THE RIO GRANDE RIFT

The Rio Grande rift is a north-trending and northward-narrowing (propagating) zone of lithospheric extension expressed in the upper crust by a series of north-south–trending en-echelon basins of middle to late Cenozoic age that extend more than 1000 km from central Colorado through New Mexico into west Texas. Beginning to develop ca. 30–35 Ma, the Rio Grande rift follows slightly older zones of weakness in the lithosphere associated with Laramide contractional welts and north-trending belts of Paleocene arc volcanism, both superimposed on basement structural grain of Proterozoic and Paleozoic ancestry (Chapin, 1979; Keller and Baldridge, 1999; Smith, 2004; van Wijk, 2005). The southern part of La Ristra skirts the northern margins of the east-stepping, actively extending basins and continues along the adjacent flanking uplifts—a region described as the "eastern rift boundary" (Pazzaglia and Hawley, 2004; Fig. 1).

The Rio Grande rift can also be defined as a region of high heat flow (Reiter et al., 1975). In the Albuquerque Basin, areas of high heat flow (>95 mW m^{-2}) appear to be associated with zones of focused extension; the background heat flow for the Basin is ~80 mW m^{-2}, and heat flow values drop quickly near the eastern rift boundary (Fig. 1; Reiter et al., 1975, 1986). Rather abrupt heat flow changes are also noted near the eastern rift boundary between Socorro and Alamogordo (Fig. 1).

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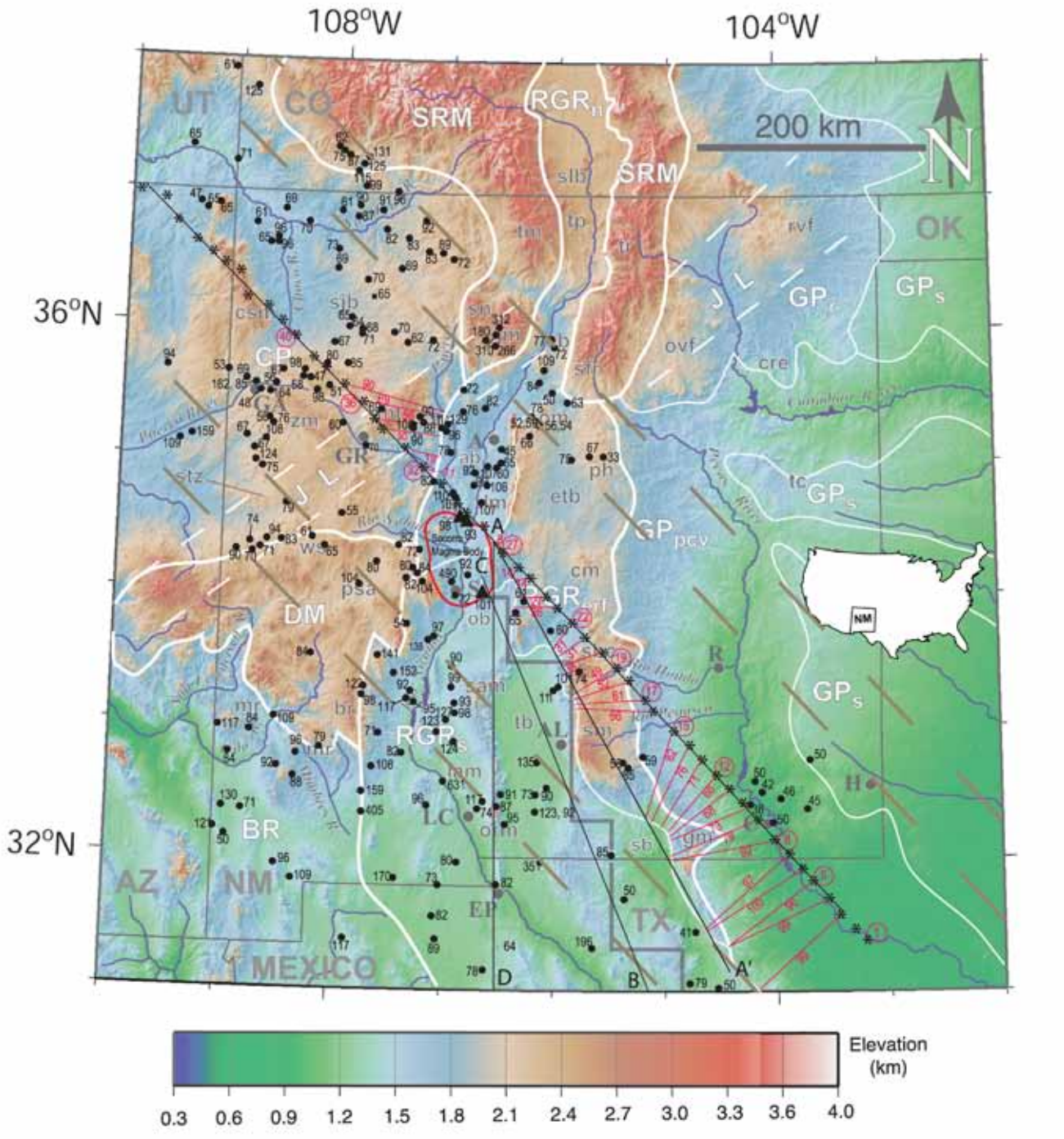

Figure 1. Map of La Ristra profile, geologic provinces, physiographic features, and heat flow data (modified from Pazzaglia and Hawley, 2004; Reiter, 2009). Cities (large dots) near La Ristra: A—Albuquerque; Al—Almogordo; EP—El Paso; GA—Gallup; GR—Grants; H—Hobbs; LC—Las Cruces; R—Roswell; S—Socorro. Geologic provinces outlined by white lines: BR—Basin and Range; CP—Colorado Plateau; GP—Great Plains; JL—Jemez lineament; RGR_s—Rio Grande rift south; RGR_n—Rio Grande rift north; RGR_{erf}—Rio Grande rift eastern rift flank; SR—Southern Rocky Mountains. See Pazzaglia and Hawley (2004) for a complete list of physiographic features (small letters) and cities. Basins of interest: ab—Albuquerque Basin; ob—Oscura Basin; sb—Salt Basin; tb—Tularosa Basin. Dashed brown lines indicate 160 km (approx. extent of seismic swath average) and 100 km from La Ristra. Red tie lines—distance from eastern edge of Rio Grande rift to seismic stations (asterisks); red numbers along tie lines—distance (in km); seismic station numbers are in red and circled. Heat flows (black dots) presented or referenced in Decker (1975), Roy et al. (1983), Reiter et al. (1975), Shearer and Reiter (1981), Reiter and Tovar (1982), Reiter and Jordan (1996), and Reiter (2008, 2009). Three new heat flow estimates (triangles) are near the Socorro Magma Body (Reiter et al., 2010). A–A′ is straight line approximation connecting the eastern boundary of Rio Grande rift from southern Albuquerque Basin to station 3 projection on La Ristra. C–B is straight line approximation of southeast step-wise suggested thermal boundary of Rio Grande rift (gray stepping line). A–D is north-south line (see southern and southeastern New Mexico).

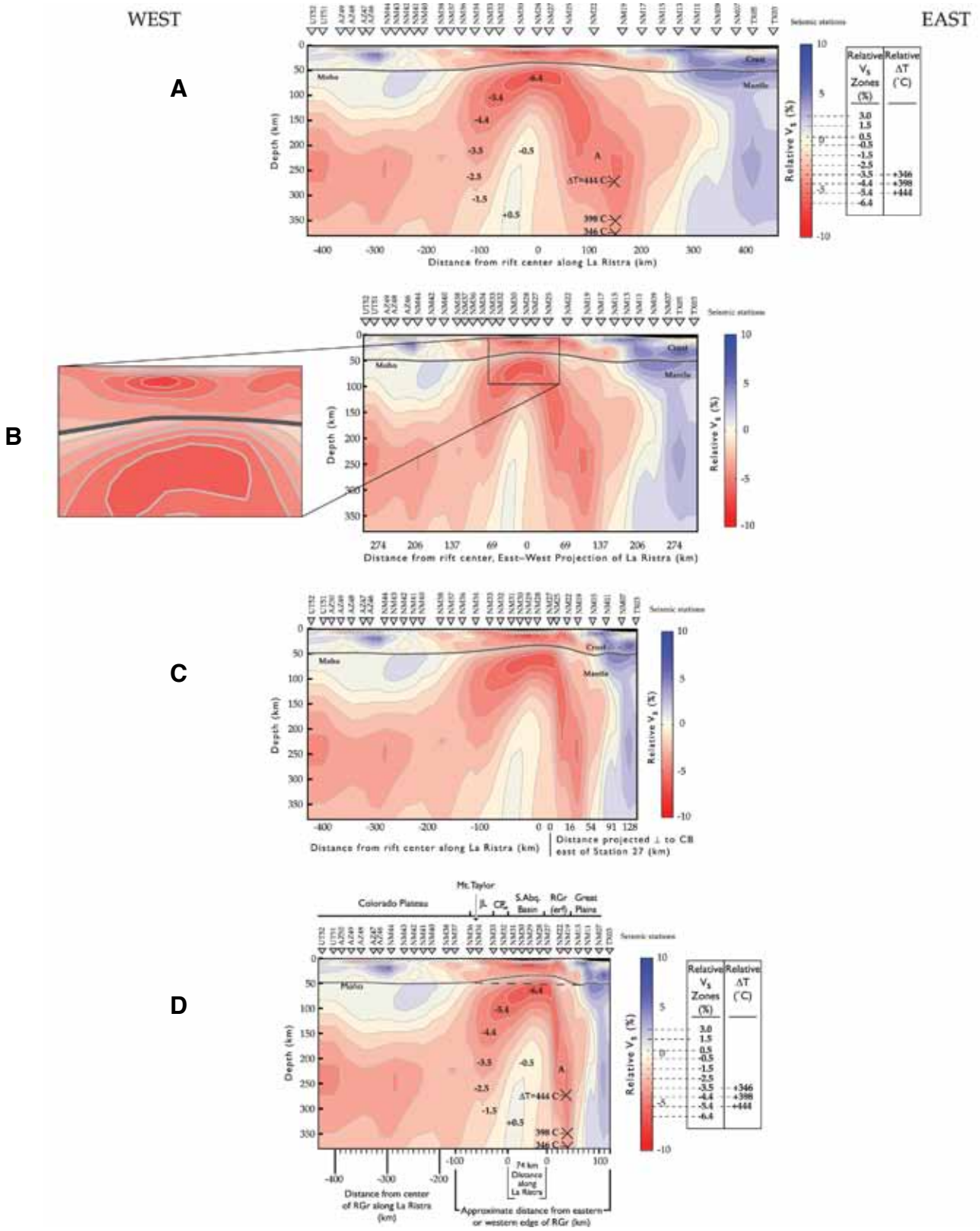

Figure 2. (A) Cross section along La Ristra of relative *Vs* (Δ*Vs*/*Vs*) referenced to 1-D standard model AK135 in mantle and laterally averaged structure in the crust (modified, making vertical and horizontal scales equal; from West et al., 2004). Relative Δ*T* is the estimated temperature increase above the standard model at the base of a given relative *Vs* zone, indicated by X. A indicates a jog or lateral shift in the relative *Vs* cross section. (B) Same as A but projected onto east-west line; cutout enlarges area under the rift. (C) Same as A but projected normal to C–B in Figure 1. (D) Same as A but projected normal to A–A′ and to western rift boundary where indicated (see text). CP_w—Colorado Plateau wedge; JL—Jemez Lineament; RGr—Rio Grande rift; RGr(erf)—Rio Grande rift (eastern rift flank). Distance across southern Albuquerque Basin (between zeroes) is the same as along La Ristra. Relative *Vs* zones (%) are chosen with computer aid. Dashed line under the southern Albuquerque Basin represents pre-rift Moho, possibly deeper in the Laramide mountain belt. A indicates a jog or lateral shift in the relative *Vs* cross section.

However, as discussed by Morgan et al. (1986), the eastern boundary of the southern Rio Grande rift is more elusive. For example, in the Salt Basin there is only one shallow heat flow measurement near the western boundary of the Basin (sb on Fig. 1); however, data to the southeast also suggest low heat flow west of the geomorphic rift boundary. We therefore use characteristic Basin and Range heat flows of 85 and 79 mW m^{-2}, as well as the lower values characteristic of the Great Plains (41–50 mW m^{-2}), to approximate a possible "thermal" rift boundary in southern New Mexico and west Texas (Fig. 1, gray stepping line).

PRESENTATION OF CROSS SECTIONS

Figure 2A shows the relative *Vs* cross section along La Ristra (after West et al., 2004, combining crust and mantle cross sections and illustrating equivalent horizontal and vertical scales). From this figure, one may perhaps envision a convective cell transferring heat from depth in the mantle. Figure 2B is an east-west projection of the La Ristra cross section, normal to the fundamental north-south axis of the Rio Grande rift—in the same sense that Wilson et al. (2005b) projected a different model of seismic data east-west. In Figure 2B, one may notice that a fundamental change in relative seismic velocities between the Great Plains and the Rio Grande rift occurs over a shorter distance than along La Ristra (Fig. 2A), while the visualization of possible vertical heat advection appears somewhat enhanced. The change in Moho depth between the rift and neighboring geological provinces also occurs over a shorter distance.

Figure 2C shows the La Ristra relative *Vs* cross section projected normal to the C–B line (see Fig. 1) south of seismic station 27 and along La Ristra north of station 27. This projection honors the heat flow values near the southeastern boundary of the Rio Grande rift in New Mexico and west Texas and is an approximation to a series of possible east-stepping boundaries of the rift (as suggested by the gray line in Fig. 1). One may note in Fig. 2C that the transition from the Great Plains (positive relative *Vs*) to the Rio Grande rift (station 27) occurs over a much shorter distance, ~115 km as opposed to ~350 km along La Ristra or ~245 km along the east-west projection. The image of a possible vertical advection conduit near the eastern boundary of the rift appears enhanced.

Figure 2D is a composite cross section. Between A and A′ (Fig. 1) we plot the approximate shortest distance between La Ristra and the geomorphic eastern boundary of the Rio Grande rift, which closely approximates projecting La Ristra onto a normal to A–A′ in Figure 1. West of the Rio Grande rift, we also plot the distance from the western rift boundary, but across the southern Albuquerque Basin and in northwest New Mexico, the distance is along La Ristra (Fig. 2D). Figure 2D shows somewhat more foreshortening than Figure 2C east of the rift (because the projection angle is a bit more acute), with some foreshortening west of the rift in Figure 2D. The change in Moho depth between the Rio Grande rift and the Great Plains shown in Figures 2C and 2D occurs over a much shorter distance than along La Ristra, consistent with traversing normal to the rift boundary. The "true" dip of the Moho in Figure 2D is ~22°, and the angle between La Ristra and A–A′ is ~15°; these spatial relationships yield an apparent dip of ~6° (Ragan, 1968), very similar to Moho dip along La Ristra (Fig. 2A).

DEPTH OF ADVECTION CONSIDERATIONS

As shown in six different seismic models crossing North America, the western edge of the Great Plains, near the border with the Rio Grande rift, is a first-order geological and geophysical boundary between the tectonically active western United States and the continental craton (Dziewonski, 2005, p. 152). The cold, strong crust and upper mantle of the Great Plains, distinctly shown in Figure 2 by the large positive relative *Vs* velocities, has resisted extension, as focused in the Rio Grande rift, while the high-viscosity mantle under the Great Plains tends to restrain convection. Upward advection occurs in regions of extension and lithosphere thinning as along the Rio Grande rift (van Wijk et al., 2008). As seen in Figures 2B–2D, upward advection could be suggested along the boundary between the Great Plains and the Rio Grande rift, roughly between seismic stations 17 and 27—although the horizontal resolution of a similar surface-wave–velocity model is ~150 km along La Ristra, or 105 km on an east-west cross section, in the upper mantle (≤150 km depth; Wilson et al., 2005b).

To consider depths from which upward advection may originate near the eastern rift boundary, we first chose the greatest *Vs* anomaly zones below 200 km for which a base depth could be estimated; these depths are shown as large Xs in Figures 2A and 2D. Below ~200 km partial melting is typically unexpected (Asimov, 2000); therefore, at the depths of interest (≥274 km), the *Vs* anomalies should be caused mainly by increased temperature. Relative *Vs* change as a function of depth (temperature) is given by Karato (1993); but because of the dependence on mineralogy and composition, the function may be uncertain to 30% (Julian, 2005). In Table 1, the three depths of interest (*Zb*), at the bases of the relative *Vs* anomalies, are correlated with temperatures from an average geotherm for the mantle above the transition zone (Jeanloz, 2000) to yield corresponding temperatures [*T*(Geo)]. Temperature increases (including uncertainties) are estimated from relative *Vs* as a function of depth-temperature (Karato, 1993). These temperature increases (ΔT, Table 1; relative ΔT, Fig. 2) are added to *T*(Geo) to estimate the present temperatures at the base of the anomalous *Vs* zones (Table 1; *T* with uncertainty limits *T* min and *T* max).

From mantle geotherm estimates to the base of the transition zone (Jeanloz, 2000), the estimated present temperatures (*T*) correspond to depths *Z* (Table 1) on the upwelling geotherm of Jeanloz (2000; the average geotherm temperature would place the estimated depth below the transition zone). The average of these three depth estimates is ~624 ± 32 km. The upper temperature limit estimates (*T* max) place the corresponding depths (*Z* max) below the bottom of the transition zone at 660 km. The lower limiting temperatures (*T* min) are correlated to depths from both the upwelling and average geotherms (Jeanloz, 2000; Table 1, *Z* min, Upw [upwelling] and Ave [average]). These depth estimates average 496 ± 48 km and 590 ± 47 km, respectively. Recognizing the large uncertainties in the change of *Vs* with temperature, and in estimated mantle geotherms, we suggest that upwelling originates in, or possibly

TABLE 1. RELATIONSHIP BETWEEN RELATIVE Vs AND TEMPERATURE INCREASE, ESTIMATE OF POSSIBLE ADVECTION DEPTH

Relative *Vs*– or Δ*V* (%)	*Zb* – Base Δ*Vs* zone (km)	*T*(Geo) (°C)	Δ*T* (°C)	Δ*T* min (°C)	Δ*T* max (°C)	*T* (°C)	*T* min (°C)	*T* max (°C)	*Z* Upw (km)	*Z* min Upw – Ave (km)	*Z* max n/a
–5.4	274	1337	444	342	635	1781	1679	1972	633	495 – 589	n/a
–4.4	348	1355	398	306	568	1752	1661	1921	588	449 – 543	n/a
–3.5	415*	1453	346	266	494	1799	1719	1947	651	544 – 637	n/a

*35 km depth addition estimated at the same width in the –4.4% relative Vs zone just above.

Note: Zb is at the base of the relative *Vs* zone from Figure 2; *T*(Geo)—temperature at *Zb* estimated from the average geotherm through the upper mantle (Jeanloz, 2000); Δ*T*—temperature increase estimates corresponding to relative *Vs*-depth (temperature) dependence (Julian, 2005; Karato, 1993) where Δ*T* min and Δ*T* max are estimated limits (uncertainty to perhaps 30%; Julian, 2005); *T*—present estimated temperature at *Zb* = *T*(Geo) + Δ*T*; *T* min and *T* max—associated uncertainty limits; *Z* with associated limits *Z* max and *Z* min—depth estimates for *T* from the upwelling geotherm (Upw) or from the average geotherm (Ave) (Jeanloz, 2000); however, depth estimates *Z* for *T* from the average geotherm (Ave) are below the transition zone, and both depth estimates for *T* max (Upw and Ave) are below the transition zone (Jeanloz, 2000).

crosses, the transition zone. The medial value of *Z* suggests upwelling from the lower transition zone (Table 1, *Z* Upw).

The difference between the upwelling geotherm and the average geotherm is ~180 °C at 410-km depth and ~80 °C at 650 km (Jeanloz, 2000). A temperature increase of 100 °C depresses the 410-km discontinuity by ~8 km and raises the 660 km discontinuity by ~5 km (with considerable uncertainties; Julian, 2005). We may therefore anticipate a depression of ~14 km at the 410-km discontinuity and a shallowing of the 660-km transition by ~4 km if upwelling indeed represents the present in-situ geotherm for the upward advection conduit as suggested in Figure 2 below ~200 km. Along La Ristra, small undulations of the 410 km and 660 km discontinuities are noted (Wilson et al., 2005a); from that study, we observe ~20-km deepening of the 410-km discontinuity and perhaps ~6 km shallowing of the 660-km discontinuities between seismic stations 15 and 21. This observation may be consistent with upwelling and our estimates of advection-increased temperatures.

DISCUSSION

La Ristra traverses ~45° to the north-south axis of the Rio Grande rift and more acutely to potential southeastern boundaries of the rift. Swath averaging of data to ~160 km on either side of the profile also implies imaging different amounts of neighboring geologic provinces at different stations; that is, moving along La Ristra from the southeast to the northwest, the amount of the Great Plains included in the averaged cross section gradually decreases while the amount of the Rio Grande rift and its eastern rift flank gradually increases. These considerations suggest that apparent broadening of the transition boundary between the Rio Grande rift and the Great Plains along La Ristra is a matter of perspective. Possible jogs (lateral shifts) in the relative *Vs* cross section may also occur between stations where the distance to the rift changes markedly; e.g., the jog at ~220 km depth in the −5.4% relative *Vs* zone occurs where the distance to the rift margin changes rapidly between stations 19 and 23 (A on Figs. 2A and 2D).

Our different projections show modest changes in the cross sections west of the Rio Grande rift because La Ristra is nearly normal to the trend of the Jemez Lineament, a young, mantle-fed volcanic zone bordering the rift, and thus differences between distances along La Ristra and seismic stations to the western rift boundary are much less than along the southeast profile. The most obvious feature of the different La Ristra projections is a potentially better visualization of a possible upward advection conduit along the eastern boundary of the Rio Grande rift. This perspective is generally compatible with models showing a distinct mantle seismic discontinuity near the eastern boundary of the Rio Grande rift (Dziewonski, 2005; West et al., 2004). High velocities east of the rift indicate a cooler, stronger mantle resistive to advection, thereby guiding an asymmetrical flow system that appears to rise near the eastern rift margin and may descend west of the rift axis. The overall cross sections suggest this asymmetrical flow system; however, present seismic data may not be able to resolve the narrow seismically anomalous zones suggested in Figures 2C and 2D (Dziewonski, 2005), and therefore these projections are viewed only as possibilities.

In all of the projections, a very prominent negative relative *Vs* zone (−6.4%) appears in the upper mantle from ~50–80-km depth under the southern Albuquerque Basin (Fig. 2). This depth is consistent with a heat source proposed from heat flow data (Reiter, 2009) and, therefore, this slow *Vs* anomaly should result from both elevated temperatures as well as partial melting. Below the −6.4% relative *Vs* zone, the magnitude of negative relative *Vs* decreases with depth, and at ~250 km, relative *Vs* becomes positive. Relating relative *Vs* to temperature and partial melting would suggest that this observed pattern is not characteristic of typical diapir upwelling, which should maintain elevated temperatures in the rising advection column. Passive upwelling of sub-adiabatic upper mantle material or compositional heterogeneities in the upper mantle have been suggested as possible alternative conditions supporting upwelling under the rift (West et al., 2004; van Wijk et al., 2008).

Above the −6.4% relative *Vs* zone, the magnitude of negative relative *Vs* also decreases upward to the Moho, as below the −6.4% zone (Fig. 2B, cutout). From these observations, we suggest that the most anomalous zone in the upper mantle results from mass flux and associated partial melting below 50 km. In Figures 2B–2D, upwelling suggested between stations 22 and 26 appears to be a potential conduit feeding

warmer, decompressionally partial melted material to the eastern part of the most anomalous relative *Vs* zone (−6.4%).

In Figure 2B (cutout), a mid-crustal relative *Vs* anomaly is shown directly above the most anomalous zone in the upper mantle. The mid-crustal anomaly is spatially nearly coincident with the Socorro Magma Body (Balch et al., 1997), and likely represents a series of basaltic intrusions derived from the upper mantle anomalous *Vs* (−6.4%) region during Pliocene-Pleistocene time (West et al., 2004; Reiter et al., 2010).

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GSA Today: *Twenty Years…*

…and Counting!

Over the past twenty years, *GSA Today* has provided high-quality science articles, commentary, and Society news to GSA members. Now in its twenty-first year, *GSA Today* reaches more than 23,000 print subscribers and online readers.

GSA Today was first printed under this title in 1991. Its roots—*The Geologist Newsletter* and *GSA News & Information*—began as offshoots of the Society's flagship journal, *GSA Bulletin*. Until 1961, the news of the Society, including presidential addresses and meeting abstracts and proceedings, was published as part of *GSA Bulletin*. As *GSA Bulletin* evolved into a science-only journal, GSA leadership felt the need to create a new print outlet for GSA news and meetings information.

The first iteration of a separate GSA news bulletin was *The Geologist Newsletter*. This four-page periodical was published from 1966 to 1981. As GSA membership and Society activities grew, the newsletter increased to 20 pages and was renamed, fittingly, *GSA News & Information*. Additional meeting details, the tables of contents for *Geology* (which launched in 1973) and *GSA Bulletin*, and such topics as GSA's outreach endeavors in education, could now be highlighted.

GSA continued to grow, and so did its publications. In November 1990, *GSA News & Information* announced a major retooling, including a new title, *GSA Today*, along with a redoubled effort to keep readers informed about Society news, geoscience policy and legislation, and, the core of the society, its science. Thus, the most important change of all: the addition of a science article. *GSA Today*'s first science article (Jan. 1991, v. 1, no. 1, p. 1, 3–4) was Donald L. Turcotte's "Fractals in geology: What are they good for?" The first science and forum editors were Eldridge M. Moores and Bruce F. Molnia, respectively. In his introduction, Molnia wrote, "This inaugural issue … represents a major step forward from the monthly newsletter of the past" (p. 2), the result, noted then GSA Executive Director F. Michael Wahl, of "more than two years of deliberation by GSA Council" (p. 2).

For the first five years, *GSA Today* was printed and distributed in tabloid format. In 1996, *GSA Today* editorial and production staff opted to drop the tabloid layout in favor of a more user-friendly magazine-sized product.

The next major change came in January 2001, when *GSA Today*'s production manager, Margo Good, refined the design of the magazine. Each issue would now feature a striking science-article–related image on the front cover with room for full-page advertising on the inside and back covers. This would in turn provide support for an increase in the quality and number of color graphics. Best of all, the new design meant that the science article could run on consecutive pages, rather than beginning on the front cover and jumping to additional pages inside the issue.

In 2006, to strengthen the magazine's science and policy content, *GSA Today* science co-editors Keith Howard and Gerry Ross added a new article series called "Groundwork." This series would offer authors a platform for short, hot-topic or issue-driven articles to *lay the groundwork* for furthering the influence of earth science on education, policy, planning, and funding. Groundwork articles span such topics as "Advocates for cold-blooded dinosaurs: The new generation of heretics," published in 2007 (v. 17, no. 1, p. 45–46); "Accreditation: Wrong path for the geosciences" (2008, v. 18, no. 10, p. 52–53); and "Geological mapping goes 3-D in response to societal needs" (2010, v. 20, no. 8, p. 27–29).

Another addition to *GSA Today* is the "Geologic Past" series (beginning in 2005), which highlights and summarizes science articles and presidential addresses in *GSA Bulletin*, dating back to the beginning of the Society (1888; the first issue of *GSA Bulletin* was published in 1890). Examples of Geologic Past articles include "When the Continents Crept Away" ([1910], 2005, v. 15, no. 7, p. 29); "Geology of the World War and After" ([1919], 2009, v. 19, no. 3, p. 10); "The Problem of Petroleum" ([1939], 2009, v. 19, no. 6, p. 13); and "The Role of Minerals in the Present International Situation" ([1939], 2009, v. 19, no. 8, p. 28). The intent of this series is to bring to the reader's attention GSA's leadership in quality science publications even into the early years of the Society as well as to show that *GSA Bulletin* articles remain relevant today.

GSA's mission is "to be a leader in advancing the geosciences, enhancing the professional growth of its members, and promoting the geosciences in the service to humankind and stewardship of the Earth." Part of this mission is directly tied to education. Teachers and college instructors report that they often use *GSA Today* science articles, which are open-access and online back to 1995, in the classroom because they are written to be understood by a broad audience and

often include detailed color graphics. Some instructors have even called *GSA Today* science articles "invaluable" to their curriculum.

GSA publications have also led the way in "going green." From the first issue, *GSA Today* has been printed on recycled paper, and it has used soy inks since 1992. In 2008, *GSA Today* moved to Forest Stewardship Council (FSC)–certified paper, which emphasizes both the use of recycled fibers and constructive forest management. Today, *GSA Today* is printed on Sustainable Forestry Initiative (SFI)–certified paper. The emphasis remains the same: to remain as green as possible while still working with a print medium. Along with these initiatives, GSA has been offering its journals and *GSA Today* on CD since 1993.

For a 10-year retrospective of top geoscience articles (as selected by *GSA Today*'s managing editor), see "*GSA Today* science articles: Hot topics and recurring themes, 1998 to 2008" (2009, v. 19, no. 1, p. 41–47).

GSA Today continues to invite submissions of short commentary, comments on science and Groundwork articles, and letters to the editor, along with the science and Groundwork articles themselves. To keep pace with the ever-growing Web audience, full issues of *GSA Today* are available online, free of charge. As well, *GSA Today*'s editorship has expanded into the world of Web 2.0, reaching additional readers through the Society e-news magazine, *GSA Connection*, and interacting with members via social media networks, including Facebook and Twitter.

For the past two decades, *GSA Today* has presented its readers with fresh topics in geology as well as longstanding and evolving research. Readers have called it "Top-Class," "an absolute life saver for a graduating student," and "a staple for geologists." One can only imagine what the next 20 years will bring for *GSA Today,* the Society, and the science.

Editor's note: *This article was researched and developed by GSA Communications & Marketing intern April Zemyan.*

CALL FOR NOMINATIONS

2011 GSA DIVISION AWARDS

GSA Division: Sedimentary Geology

LAURENCE L. SLOSS AWARD FOR SEDIMENTARY GEOLOGY

Nominations due 20 February 2011

Submit (1) a cover letter describing the nominee's accomplishments in sedimentary geology and contributions to GSA and (2) a curriculum vitae via e-mail to Paul Link, secretary, Sedimentary Geology Division, linkpaul@isu.edu.

The Laurence L. Sloss Award for Sedimentary Geology is given annually to a sedimentary geologist whose lifetime achievements best exemplify those of Larry Sloss—i.e., achievements that contribute widely to the field of sedimentary geology and service to GSA. The Sedimentary Geology Division's management board will choose the recipient from two nominees selected by the nominations committee, and the award will be presented at the 2011 GSA Annual Meeting in Minneapolis. Monies for the award are derived from the annual interest income of the Laurence L. Sloss Award for Sedimentary Geology Fund, which is administered by the GSA Foundation.

GSA Division: Coal Geology

GILBERT H. CADY AWARD

Nominations due 28 February 2011

Submit three copies of the following to Jack C. Pashin, Energy Investigations Program, Geological Survey of Alabama, P.O. Box 869999, Tuscaloosa, AL 35486-6999, USA; jpashin@gsa.state.al.us: (1) name, office or title, and affiliation of the nominee; (2) date and place of birth; (3) education, degree(s), and honors and awards; (4) major events in his or her professional career; and (5) a brief bibliography noting outstanding achievements and accomplishments that warrant nomination.

The Gilbert H. Cady Award is given for outstanding contributions in the field of coal geology. The first award, established by the Division in honor of Gilbert H. Cady, was presented in 1973. The award recognizes contributions that advance the field of coal geology within and outside North America and will be presented at the Coal Geology Division Business Meeting at the 2011 GSA Annual Meeting in Minneapolis. Nominations will be evaluated by the Gilbert H. Cady Award Panel. Monies for the award are derived from the annual interest income of the Gilbert H. Cady Memorial Fund, administered by the GSA Foundation.

GSA Division: Geophysics

GEORGE P. WOOLLARD AWARD

Nominations due 15 February 2011

Submit online via link at www.gsageop.org. Nominations should include a description of the nominee's specific contributions and their scientific impact.

The George P. Woollard Award recognizes outstanding contributions to geology through the application of the principles and techniques of geophysics. The award is presented at each annual GSA meeting in conjunction with the Geophysics Division and the Structural Geology and Tectonics Division business meetings. A highlight of the presentation is the honorary George P. Woollard Technical Lecture by the recipient before the award ceremony. Award funds are administered by the GSA Foundation.

GSA Division: Quaternary Geology and Geomorphology

FAROUK EL-BAZ AWARD FOR DESERT RESEARCH

Nominations due 2 April 2011

Submit nominations, including (1) a statement of the significance of the nominee's research, (2) a curriculum vitae, (3) letters of support, and (4) copies of no more than five of the nominee's most significant publications related to desert research to Sara Rathburn, Dept. of Geosciences, Colorado State University, Fort Collins, CO, 80523-1482, USA; rathburn@cnr.colostate.edu. Please submit electronically unless hardcopy previously approved.

The Farouk El-Baz Award for Desert Research rewards excellence in desert geomorphology research worldwide. It is intended to stimulate research in desert environments by recognizing an individual whose research has significantly advanced the understanding of the Quaternary geology and geomorphology of deserts. Although the award primarily recognizes achievement in desert research, the funds that accompany it may be used for further research. The award is normally given to one person but may be shared by two people if the recognized research was the result of a coequal partnership. Any scientist from any country may be nominated. Because the award recognizes research excellence, self-nomination is not permitted. Neither nominators nor nominees need be GSA Members. Monies for the award are derived from the annual interest income of the Farouk El-Baz Fund, administered by the GSA Foundation.

2011 STUDENT
Grants, Awards, & Scholarships

ANTOINETTE LIERMAN MEDLIN SCHOLARSHIP IN COAL GEOLOGY

Applications due 15 February 2011

GSA's Coal Geology Division is pleased to offer the Antoinette Lierman Medlin Scholarship in Coal Geology for the 2010–2011 academic year. The scholarship will provide one full-time student involved in coal geology research (origin, occurrence, geologic characteristics, or economic implications of coal and associated rocks) with up to US$2,000 in financial support for his or her project for one year. This year's scholarship recipient may also be provided with a stipend to present results at the 2011 or 2012 GSA Annual Meeting.

For the academic year 2010–2011, the Coal Geology Division is also offering a field study award of up to US$1,500. The recipient of this award will also be eligible to receive travel funds to present the results of his or her study at the 2011 or 2012 GSA Annual Meeting.

A panel of coal geoscientists will evaluate proposals for the scholarship and the field study award. Students may apply for the scholarship award, the field study award, or both; however, only one award will be made to a successful applicant.

To apply, submit five copies of the following to Sue Rimmer, Southern Illinois University, Geology-SIUC, Mailcode 4234, Carbondale, IL 62901, USA; srimmer@siu.edu: (1) a cover letter indicating which award(s) is(are) sought; (2) a concise (no more than five double-spaced pages, including references) statement of objectives and methods and a summary of how the scholarship funds will be used to enhance the project; and (3) a letter of recommendation from the student's immediate advisor that includes a statement of financial need and the amount and nature of other available funding for the research project.

HISTORY AND PHILOSOPHY OF GEOLOGY STUDENT AWARD

Applications due 3 May 2011

This award, established by GSA's History and Philosophy of Geology Division in 2004, is made possible by a bequest from the estate of Mary C. Rabbitt. The award applies to GSA Annual Meeting paper proposals based on the following topics: (1) the history of geology; (2) a literature review of ideas for a technical work or thesis/dissertation; and/or (3) some imaginative aspect of the history of geology not previously thought of. Consideration will be given to both undergraduate and graduate students who are in good standing at the time of application; the presentation may take place after the student has graduated. Students must be lead authors on the paper (faculty advisors may be listed as second authors), and while both oral and poster presentations are acceptable, oral presentations are preferred. Applicants need not be GSA members or members of the History and Philosophy of Geology Division.

Further guidelines and the application form are online at http://gsahist.org/HoGaward/awards.htm. *Questions?* Contact the Division secretary-treasurer, Jane P. Davidson, at jdhexen@unr.edu.

CALL FOR NOMINATIONS

JOHN C. FRYE ENVIRONMENTAL GEOLOGY AWARD

Deadline: 31 March 2011

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

Anyone may submit a nomination, following these criteria:

1. The paper must be from a GSA or state geological survey publication;
2. The paper must have been published during the preceding three full calendar years; and
3. The nomination must include a paragraph stating the pertinence of the paper (see basis for selection).

Basis for Selection

Each paper will be judged on its uniqueness or significance as a model of its type of work along with its overall worthiness. It is preferred that the paper be directly applicable to informed laypersons (e.g., planners, engineers). In addition, nominated papers must

1. Establish an environmental problem or need;
2. Provide substantive information on the basic geology or geologic process pertinent to the problem;
3. Relate the geology to the problem or need;
4. Suggest solutions or provide appropriate land-use recommendations based on the geology;
5. Present the information in a manner that is understandable and directly usable by geologists; and
6. Address the environmental need or resolve the problem.

Please send nominations to Grants, Awards, and Recognition,
GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA; awards@geosociety.org.

THE GEOLOGICAL SOCIETY OF AMERICA®

GSA–ExxonMobil

ExxonMobil

BIGHORN BASIN FIELD AWARD

Professional Development Opportunity for Students and Faculty

Award application deadline: 1 April

Field schools have long been a mainstay for geoscience education. They offer an intensive hands-on experience using classroom and laboratory knowledge to solve geological problems in the field. GSA, in cooperation with ExxonMobil, currently offers members a one week field course during which they can learn practical, multidisciplinary, integrated basin exploration. The third annual GSA-ExxonMobil Bighorn Basin Field School Award offers up to 20 undergraduate and graduate students and five faculty members a chance to receive this high-quality educational experience in the spectacular Bighorn Basin of north-central Wyoming, USA. The course is free to accepted participants, and all transportation, meals, and living expenses are covered.

COURSE FORMAT

The Integrated Basin Exploration Field School provides an opportunity to study excellent exposures of individual hydrocarbon system play elements, such as source, seal, reservoir and structure, within a prolific hydrocarbon basin. The school is centered in Cody, Wyoming, USA, surrounded by the Beartooth Mountains, Rattlesnake Mountain, Cedar Mountain, Heart Mountain, and the McCulloch Peaks. Participants will work in teams of four students and one faculty member. The majority of the course is field-based supplemented by lectures and exercises in the classroom.

For more than a century, the Bighorn Basin has been a focus of study by academic, industry, and government geoscientists, who focused on the exceptional outcrop exposures, as well as subsurface borehole and seismic data. Our current understanding of the basin derives from both industry and academic perspectives. This is not, however, a course on the detailed geology of the Bighorn Basin. Instead, our objectives are to introduce the concepts of integrated basin analysis, including evaluation, prediction, and assessment of play element distribution and quality, using the Bighorn Basin as a natural laboratory. Via this laboratory, we will explore the concepts, methods, and tools of petroleum geoscience used on a day-to-day basis in the energy industry. Discussions on the outcrop and in the classroom will focus on how we make decisions with limited data and how critical information is identified in order to evaluate risk versus uncertainty. We also use the excellent field setting to teach fundamental geoscience skills in structure, stratigraphy, geochemistry, and more.

The importance of integration across disciplines and scales is stressed throughout the course. We will also focus on fundamental basin formation, fill, and evolution processes and their interaction to create play elements from regional to prospect scale. These discussions will include consideration of plate motions, paleogeography, sequence stratigraphy, structural deformation, sedimentology, rock properties, subsurface imaging, burial history, and fluid migration.

By the end of the course, teams will have generated play element maps, play summary charts, cross sections, and play fairway maps. Highlights of this course include the presentation of these ideas to the group and the ensuing discussions about how these ideas and play assessments can be further developed.

INSTRUCTORS

Steve May, Chief Geoscientist, ExxonMobil Upstream Research Co.; Lori Summa, Senior Technical Consultant, ExxonMobil Upstream Research Co.; Bob Stewart, Supervisor, ExxonMobil Exploration Co.; and Gary Gray, Technical Team Leader, ExxonMobil Upstream Research Co. These geoscientists represent over 100 years of research in integrated basin analysis, with specific skills in tectonics, geochemistry, structure, sequence stratigraphy, sedimentology, paleontology, hydrocarbon systems analysis, and integrated play analysis.

APPLICATIONS

Please submit a résumé or curriculum vitae, academic transcripts, two letters of recommendation, and a cover letter by 1 April to http://rock.geosociety.org/ExxonMobilAward. Undergraduates, graduates, and professors are encouraged to apply. **Questions?** Contact Jennifer Nocerino, jnocerino@geosociety.org, +1-303-357-1036.

2011 GSA Section Meeting Mentor Programs

STUDENTS—Meet Your Career Mentors!

Plan now to attend a Shlemon Mentor Program and/or a Mann Mentor Program in Applied Hydrogeology at your 2011 Section Meeting to talk one-on-one with practicing geoscientists. These volunteers will answer your questions and share insights on how to get a job after graduation.

Roy J. Shlemon Mentor Program in Applied Geoscience. *Sponsored by the GSA Foundation.* This is a chance for students to discuss career opportunities and challenges with professional geoscientists from multiple disciplines. Students will receive FREE lunch tickets in their registration packets to attend this program.

The John Mann Mentors in Applied Hydrogeology Program. *Sponsored by the GSA Foundation.* This event presents opportunities for students interested in applied hydrogeology or hydrology as a career to interact and network with practicing hydrogeologic professionals. Whether you've already decided to head down the hydro career path or whether you just would like to know more about these career options, this meeting is for you! This program is a focused, small-scale event that features a FREE lunch for participants. Students will receive a ticket to attend in their registration packets.

Space for these events is limited, so plan to arrive early: first come, first served. For further information, contact jnocerino@geosociety.org.

THE GEOLOGICAL SOCIETY OF AMERICA®

NORTHEASTERN/ NORTH-CENTRAL JOINT SECTION MEETING
Pittsburgh, Pennsylvania, USA
Shlemon Mentor Luncheons
Sun., 20 March, and Mon., 21 March, noon–1:30 p.m.
Mann Mentors in Applied Hydrogeology Luncheon
Tues., 22 March, noon–1:30 p.m.

SOUTHEASTERN SECTION MEETING
Wilmington, North Carolina, USA
Shlemon Mentor Luncheon
Thurs., 24 March, noon–1:30 p.m.
Mann Mentors in Applied Hydrogeology Luncheon
Fri., 25 March, noon–1:30 p.m.

SOUTH-CENTRAL SECTION MEETING
New Orleans, Louisiana, USA
Shlemon Mentor Luncheon
Mon., 28 March
Mann Mentors in Applied Hydrogeology Luncheon
Tues., 29 March

ROCKY MOUNTAIN/ CORDILLERAN JOINT SECTION MEETING
Logan, Utah, USA
Shlemon Mentor Luncheon
Wed., 18 May, 11:45 a.m.–1:15 p.m.
Mann Mentors in Applied Hydrogeology Luncheon
Thurs., 19 May, 11:45 a.m.–1:15 p.m.

Penrose Conference Announcement

Comparative evolution of past and present accretionary orogens: Central Asia and the Circum-Pacific

Urumqi, Xinjiang Uygur Autonomous Region, China
4–10 September 2011

CONVENERS

Alfred Kröner, *Beijing SHRIMP Center, Chinese Academy of Geological Sciences, Beijing, China, and Institut für Geowissenschaften, Universität Mainz, Germany, kroener@uni-mainz.de*

Robert J. Stern, *Geosciences Dept., University of Texas at Dallas, Richardson, Texas, USA, rjstern@utdallas.edu*

Bor-Ming Jahn, *Dept. of Geosciences, National Taiwan University, Taipei, Taiwan, bmjahn@ntu.edu.tw*

Wenjiao Xiao, *State Key Laboratory of Lithospheric Evolution, Institute of Geology & Geophysics, Chinese Academy of Sciences, Beijing, China, wj-xiao@mail.igcas.ac.cn*

Lifei Zhang, *Dept. of Earth & Space Sciences, Peking University, Beijing, China, lfzhang@pku.edu.cn*

Robert Hall, *SE Asia Research Group, Dept. of Earth Sciences, Royal Holloway University of London, UK, robert.hall@es.rhul.ac.uk*

Alexander Kotov, *Institute of Precambrian Geology and Geochronology, Russian Academy of Sciences, St. Petersburg, Russia, abkotov-spb@mail.ru*

Reimar Seltmann, *Center for Russian and Central EurAsian Mineral Studies (CERCAMS), Dept. of Mineralogy, Natural History Museum, London, UK, r.seltmann@nhm.ac.uk*

Organizing Committee: *Qingchen Wang (Chairman) and Wei Lin (Secretary), both at Institute of Geology & Geophysics, Chinese Academy of Sciences, Beijing. Contacts and correspondence to Wei Lin, linwei@mail.igcas.ac.cn.*

DESCRIPTION AND OBJECTIVES

The Central Asian Orogenic Belt (CAOB, also known as Altaids) is one of the largest accretionary orogens on Earth and evolved over some 800 million years, from the latest Mesoproterozoic to the early Triassic. It contains a record of geodynamic processes during major Phanerozoic continental growth. There has been much discussion about its evolution over the last 20 years, and models range from a single, giant arc system to accretion of multiple arc–backarc systems. The CAOB crust appears to comprise long chains of arcs and slices of older continental crust that extend for several hundreds to thousands of kilometers. Amalgamation of these linear crustal elements and their interactions with continental margins generated considerable Phanerozoic continental growth. Its large size, from the Pacific to the Urals, and its extent across many countries and language barriers has complicated orogen-wide comparisons and correlations. Current tectonic models are largely speculative, but most see analogues with modern accretionary orogens. In view of the discovery of world-class mineral deposits, a wealth of new age and isotopic data, and much improved possibilities for international cooperation, it is now timely to discuss and compare the formation of the CAOB with that of modern accretionary orogens, such as the multiple arc terranes of the circum-Pacific in Indonesia, Melanesia, Taiwan, Japan, Alaska, and California. Such a multidisciplinary, in-depth comparison will spur research and stimulate thinking about the CAOB tectonomagmatic evolution, new concepts for accretionary orogeny in general, and new strategies for finding mineral deposits. This meeting will thus provide a unique forum to discuss what is known about the CAOB within the context of the archetypal accretionary orogens and, at the same time, bring together Asian, Russian, and Western geoscientists.

Following overview talks on the circum-Pacific orogens and components of the CAOB, key speakers will address the issue of accretionary orogeny from the viewpoint of different expertise and methodologies. These will be discussed, and shown on posters, with all participants during a three-day field trip across the Chinese Tianshan orogen in NW China and a subsequent three-day meeting in Urumqi, capital of the Xinjiang Uygur Autonomous Region. Emphasis will be on process-oriented comparisons between ongoing orogeny in the circum-Pacific region and geological observations in the CAOB. We do not think that there is a single, coherent model to explain the evolution of the vast accretionary terrane of Central Asia, but this conference should lead to a clearer path

Panorama of southern Kyrgyz Tianshan. Photo by Alfred Kröner, taken near town of Atbashi, Kyrgyzstan. The hilly terrain in the middle ground includes an ophiolitic mélange with blocks of ca. 317 Ma eclogite, marking the suture between the southern and middle Tianshan and extending into northwestern China. The snow-capped range is the Atbashi Ridge, with highest peaks from left to right at 4786 m and 4757 m.

of research and potential avenues of international collaboration. We particularly encourage the participation of young scientists from Asian countries.

ITINERARY

Day 1, Sunday, 4 Sept.: Arrival in Urumqi. Opening session in the late afternoon, followed by introductory talks on the Chinese Tianshan after dinner.

Day 2, Monday, 5 Sept.: Field trip across the Chinese Tianshan from Urumqi to Toksun. Evening talks and discussions on geology of the Tianshan.

Day 3, Tuesday, 6 Sept.: Field trip across the Chinese Tianshan from Toksun to Korla. Evening talks and discussions on geology of the Tianshan and other components of the CAOB.

Day 4, Wednesday, 7 Sept.: Return to Urumqi; optional stops en route.

Day 5, Thursday, 8 Sept.: Discussion session, led by conveners and key speakers, with emphasis on overview talks. Discussions will be supported by poster presentations, with adequate time for discussion. Evening session after dinner.

Day 6, Friday, 9 Sept.: Discussion session, led by conveners and key speakers, with thematic sessions and group discussions and supported by poster presentations. Evening session after dinner.

Day 7, Saturday, 10 Sept.: Provocative discussion session on tectonic models, research methodologies, etc., led by conveners and key speakers: What needs to be done in Central Asia and what can we learn from the comparison with the circum-Pacific?

Day 8, Sunday, 11 Sept.: Participants depart Urumqi or participate in seven-day post-conference field trip to the Chinese Altai (not part of the Penrose Conference).

LOGISTICS

The conference will be organized by the Center for International Scientific Exchanges of the Chinese Academy of Sciences, Beijing; the Centre will issue invitation letters to foreign participants, which must accompany the Chinese visa applications. Participants should arrive in Urumqi on 4 Sept. 2011 and are responsible for their own travel arrangements. Urumqi can be reached by air from Beijing, Shanghai, Guangzhou, Almaty, Bishkek, and Novosibirsk. Additional details will be provided in the registration material.

The registration fee of US$450 (registered students: US$200) will cover hotel lodging (double room occupancy) from 4 to 11 Sept., all meals, a guidebook, and transportation in the field. All meals will be taken together. Single rooms will incur an additional charge.

A seven-day post-conference field trip (including a one-day seminar) across the Chinese Altai will be organized by Prof. Min Sun of Hong Kong University. The trip begins in Urumqi on 11 Sept. and ends there on 17 Sept. The fee is ~US$700.

REGISTRATION AND APPLICATIONS

Deadline: 1 June 2011

Interested persons should send a letter of application by e-mail to Alfred Kröner at kroener@uni-mainz.de. This letter should include a brief statement about your research interests and the relevance of those interests to the focus of the conference, the topic you would like to present, and whether you are interested in submitting a manuscript for a potential GSA publication. Students should also submit a recommendation from their thesis supervisor.

Participants interested in joining the seven-day post-conference field trip to the Chinese Altai should contact Prof. Min Sun of Hong Kong University at minsun@hkucc.hku.hk. All matters concerning visa, travel, accommodation, etc., should be addressed to Mrs. Cuiling Lan, Center for International Scientific Exchanges, Chinese Academy of Sciences, at cllan@cashq.ac.cn.

Policy on Non-Registered Spouses and Friends

We appreciate your cooperation in not bringing family members or non-registered friends to the meeting for two reasons: (1) most of us will be sharing rooms with other participants; and (2) the GSA rules for Penrose meetings do not allow this practice since it tends to distract participants from the science program and field trip. If you have family or friends coming after the meeting, please ask them to arrive no earlier than the morning of Sunday, 11 Sept. 2011.

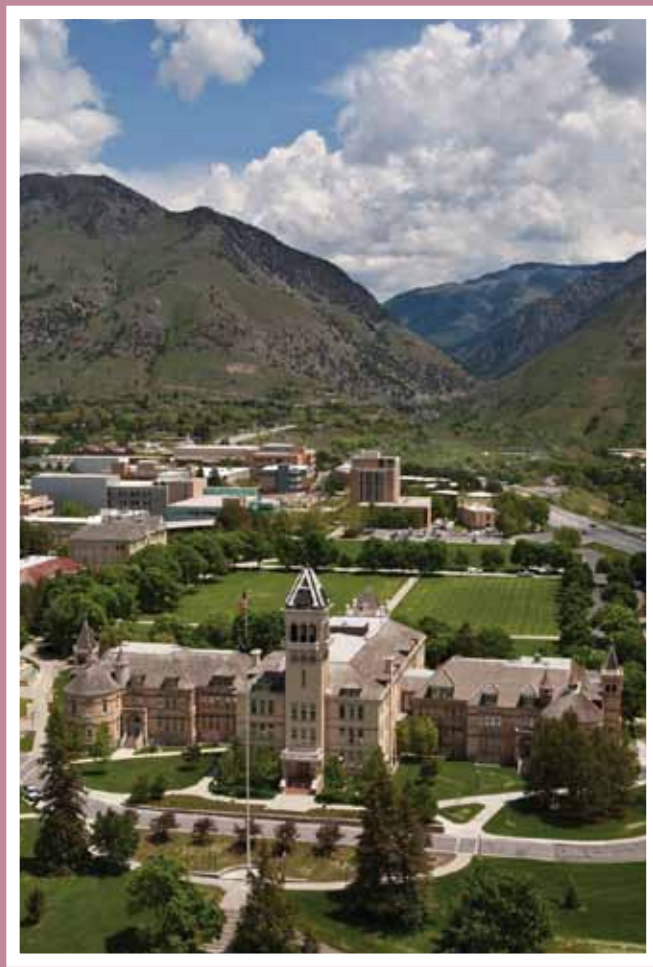
THE GEOLOGICAL SOCIETY OF AMERICA®

JOINT MEETING

63rd Annual Meeting of the Rocky Mountain Section, GSA
107th Annual Meeting of the Cordilleran Section, GSA
Logan, Utah, USA

18–20 May 2011

Logan Canyon, in the scenic Bear River Mountains. Photo by Donna Barry.



Utah State University, with the Bear River Range and Logan Canyon in the background. Photo by Donna Barry.

LOCATION

Logan, Utah, USA, is situated at a nexus of western geology, with the Rocky Mountains to the east, the Basin and Range to the west, and the Snake River Plain to the north. Geologic formations near Logan range in age from paleo-Proterozoic to Quaternary and in character from crystalline to karst.

REGISTRATION

Early Registration Deadline: 18 April 2011
Cancellation Deadline: 25 April 2011
Register at **www.geosociety.org/Sections/rm/2011mtg/**

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

	Early		Standard	
	Full	One-day	Full	One-day
Professional Member	$160	$100	$190	$110
Professional Nonmember	$180	$120	$210	$130
Student Member	$65	$50	$80	$60
Student Nonmember	$90	$65	$110	$80
K–12 Teacher or Student	$30	$20	$35	$25
Guest/Spouse	$50	n/a	$60	n/a
Short Course/Field Trip only	$35	n/a	$45	n/a

Cancellations, Changes, and Refunds

Requests for cancellations must be received at GSA Headquarters by 25 April. No refunds will be made on cancellation notices received after this date. Refunds will be mailed from GSA after the meeting; refunds for fees paid by credit card will be credited to the card identified on the registration form. GSA cannot provide refunds for on-site registration, *Abstracts with Programs,* or event ticket sales.

VENUE & ACCOMMODATIONS

The meeting will be held at the **Riverwoods Conference Center,** 615 S. Riverwoods Parkway, Logan, Utah 84321, USA. Located on the banks of the Logan River, the conference center is about two miles from Utah State University. Our headquarters hotel, the **Marriott Springhill Suites Hotel,** 635 South Riverwoods Parkway, Logan, Utah 84321, USA, +1-435-750-5180, www.loganspringhillsuites.com, is attached to the conference center. Rates include a complimentary breakfast buffet, wireless Internet, gym and indoor pool, refrigerator and microwave in every guest room, and a business center. GSA has obtained special rates at the Marriott as well as block reservations at other local hotels. For more information, go to **www.geosociety.org/Sections/rm/2011mtg/.**

OPENING RECEPTION

Tues., 17 May, 5–7 p.m., Riverwoods Conference Center. You'll receive one free drink ticket with registration; we'll provide a cash bar and complimentary hors d'oeuvres.

TECHNICAL PROGRAM
CALL FOR PAPERS

Abstract Deadline: 15 February 2011

Please submit your abstract online at **http://gsa.confex.com/gsa/2011RM/cfp.epl.** An abstract submission fee of US$10 will be charged. If you cannot submit the abstract online, please contact Nancy Wright, +1-3033571061, nwright@geosociety.org.

Theme Sessions

1. **From Contraction to Extension: The Mesozoic to Cenozoic Tectonic Evolution of the Northern Great Basin.** Joseph P. Colgan, USGS, jcolgan@usgs.gov; Chris Henry, Univ. of Nevada–Reno, chenry@unr.edu; Victoria E. Langenheim, zulanger@usgs.gov; Allen J. McGrew, allen.mcgrew@notes.udayton.edu; David M. Miller, dmiller@usgs.gov.
2. **Interactions of Climate, Tectonics, and Sedimentation in Cenozoic Basins of the Basin and Range.** Thomas Hickson, Univ. of St. Thomas, tahickson@stthomas.edu; Melissa Lamb, Univ. of St. Thomas, malamb@stthomas.edu; Paul Umhoefer, Northern Arizona Univ., paul.umhoefer@nau.edu.
3. **Deep Crustal Perspectives on Cordilleran Orogenesis.** Chris G. Mattinson, Central Washington Univ., mattinson@geology.cwu.edu; Thomas D. Hoisch, Northern Arizona Univ., thomas.hoisch@nau.edu.
4. **Neoproterozoic–Early Paleozoic Tectonic and Climatic Evolution of the Cordilleran Margin.** Carol Dehler, Utah State Univ., carol.dehler@usu.edu; Paul Link, Idaho State Univ.; Adolph Yonkee, Weber State Univ.
5. **Assembling North America: Precambrian Basement Tectonic and Geochemical Evolution of Laurentia.** David A. Foster, Univ. of Florida, dafoster@ufl.edu; Darrell J. Henry; David W. Mogk; Paul A. Mueller.
6. **Geology and Hydraulic Properties of Reservoir-Seal Systems with Implications for CO_2 Sequestration and Hydrogeology.** Alvar Braathen, UNIS, Norway, and Utah State Univ., alvarb@unis.no; Jim Evans, Utah State Univ., jim.evans@usu.edu; Elizabeth Petrie, Utah State Univ.
7. **Petrologic and Geodynamic Perspectives on Non-Arc Volcanism in the Western United States.** John Shervais, Utah State Univ., john.shervais@usu.edu; Tony Lowry, Utah State Univ., tony.lowry@usu.edu.
8. **Geochemistry of Igneous Rocks: From Small Scales to Big Pictures.** Adam Kent, Oregon State Univ., adam.kent@science.oregonstate.edu.
9. **The Mammalian Fossil Record of Utah.** Beth Townsend, Midwestern Univ., btowns@midwestern.edu; Paul Murphey, South Dakota Natural History Museum, pmurphey@sdnhm.org; Anthony Friscia, Univ. of California–Los Angeles, tonyf@ucla.edu.

Wellsville Mountains, Utah, USA. Photo credit: Becky Blankenship; courtesy U.S. Forest Service.

10. **Lake Bonneville and Beyond: Glacial-Pluvial Records of the Great Basin.** Paul W. Jewell, Univ. of Utah, paul.jewell@utah.edu; Benjamin J.C. Laabs, SUNY Geneseo, laabs@geneseo.edu; Jeffrey S. Munroe, Middlebury College, jmunroe@middlebury.edu; Jack Oviatt, Kansas State Univ., joviatt@ksu.edu.
11. **Geomorphic Evolution of Western U.S. Landscapes: Processes and Controls.** Lisa Ely, Central Washington Univ., ely@cwu.edu; P. Kyle House, USGS, pkhouse@gmail.com; Joel Pederson, Utah State Univ., joel.pederson@usu.edu; Cooper Brossy, Fugro WLA, c.brossy@fugro.com; Duane Champion, USGS, dchamp@usgs.gov.
12. **Reading Landscapes and Dirt: Understanding Past Environmental Change.** Tammy Rittenour, USU Luminescence Lab, tammy.rittenour@usu.edu; Shannon Mahan, USGS, smahan@usgs.gov.
13. **Human Impacts to Fluvial Systems and Restoration Approaches.** Sara Rathburn, Colorado State Univ., rathburn@warnercnr.colostate.edu; Ellen Wohl, Colorado State Univ. ellenw@warnercnr.colostate.edu.
14. **Water Resources of the Densely Populated Alluvial Valleys of the Western States—Processes.** Erick R. Burns, USGS Oregon Water Science Center, eburns@usgs.gov; Victor M. Heilweil, USGS Utah Water Science Center, heilweil@usgs.gov.
15. **Water Resources of the Densely Populated Alluvial Valleys of the Western States—Water Budgets and Water Management.** Sue C. Kahle, USGS Washington Water Science Center, sckahle@usgs.gov; Erick R. Burns, USGS Oregon Water Science Center, eburns@usgs.gov.
16. **When Water Conveyances Are Breached: Causes and Impacts.** Jerome DeGraff, U.S. Forest Service, jdegraff@fs.fed.us; Richard Giraud, Utah Geological Survey, richardgiraud@utah.gov.
17. **New Geologic Maps for a Changing World—Research, Methods, Products, and Interpretations (Posters).** Grant Willis, Utah Geological Survey, grantwillis@utah.gov; Bob Biek, Utah Geological Survey, bobbiek@utah.gov.
18. **Undergraduate Research (Posters).** Kathleen Surpless, Trinity Univ., kathleen.surpless@trinity.edu; K. Hannula, Fort Lewis College, hannula_k@fortlewis.edu.
19. **Idea Blast: Sharing Incidental Findings (Posters).** Susanne Janecke, Utah State Univ., susanne.janecke@usu.edu. This evening session will be held in conjunction with the Map Blast. *Note:* For this session only, you may **submit a second abstract.**

MAP BLAST

Wed., 18 May, 7–9:30 p.m., Riverwoods Conference Center

You're invited to participate in this informal evening session—no abstract needed! Bring your in-progress geologic map and post it for comments and discussion. Maps should fit on poster boards (8 ft × 4 ft). *Cash bar provided.*

FIELD TRIPS

1. **Tectonomagmatic Evolution of Distinct Arc Terranes within Blue Mountains Province, Oregon and Idaho.** C.J. Northrup, cjnorth@boisestate.edu; Mark Schmitz; Gene Kurz, Boise State Univ. Sun.–Tues., 15–17 May. US$395. Begins and ends in Boise, Idaho, USA.
2. **Karst Hydrogeology of the Bear River Range in the Logan Canyon Area, Northern Utah.** Larry Spangler, USGS. Tues., 17 May. US$60.
3. **Cryogenian ("Sturtian") Diamictite, Cap Carbonate, and Volcanic Rocks of Southeastern Idaho.** Josh Keeley; Carol Dehler, carol.dehler@usu.edu; Paul Link; Adolph Yonkee; Katie Kirkham. Tues., 17 May. US$60.
4. **Neogene Drainage Development of the Portneuf, Big Lost, and Snake River Systems, eastern Idaho.** Paul K. Link, linkpaul@isu.edu; David W. Rodgers; Glenn T. Thackray, Idaho State Univ.; Mary K.V. Hodges, USGS. Fri.–Sat., 20–21 May. US$155.
5. **New Investigations of Pleistocene Glacial and Pluvial Records in Northeastern Nevada.** Jeffrey S. Munroe, Middlebury College; Benjamin J.C. Laabs, SUNY Geneseo. Fri.–Sun., 20–22 May. US$330.
6. **Timing, Distribution, Amount, Style, and Causes of Cenozoic Extension, Northern Great Basin.** Christopher D. Henry, Univ. of Nevada–Reno, chenry@unr.edu; Joseph P. Colgan, USGS; Allen J. McGrew, Univ. of Dayton. Fri.–Mon., 20–23 May. US$325.
7. **New Insights into the Outlet of Lake Bonneville and Deltas of the Bear River.** Susanne Janecke, Utah State Univ., susanne.janecke@usu.edu; Bob Oaks, Utah State Univ. Sat., 21 May. US$60.
8. **Paleontology and Stratigraphy of Middle Eocene Rock Units in the Bridger and Uinta Basins, Wyoming and Utah.** Beth Townsend, Midwestern Univ., btowns@midwestern.edu; Paul Murphey, South Dakota Natural History Museum; Anthony Friscia, Univ. of California–Los Angeles. Sat.–Sun., 21–22 May. US$195.

WORKSHOP

Introduction to Coring

DOSECC will be conducting a workshop for early career geologists in Salt Lake City before the 2011 Joint Section Meeting. Sponsored by DOSECC and ICDP (International Continental Scientific Drilling Program), this workshop will introduce attendees to coring as a tool for scientific investigation. For more information, contact David Zur, DOSECC Education and Outreach Manager, dzur@dosecc.org.

OPPORTUNITIES FOR STUDENTS

Undergraduate and Graduate Student Presentation Awards

GSA encourages abstract submissions by student authors. To recognize exceptional work, the Cordilleran and Rocky Mountain Sections will each offer daily outstanding poster awards to both graduate and undergraduate students, as well as a single outstanding oral presentation award to both a graduate and an undergraduate student.

Undergraduate Research Posters (Theme Session 17)

Advocates: Kathleen Surpless, Trinity Univ., kathleen.surpless@trinity.edu; K. Hannula, Fort Lewis College. hannula_k@fortlewis.edu. Submissions to this session will highlight *undergraduate* student research contributions to the varied geoscience subdisciplines. Student research results from National Science Foundation–Research Experiences for Undergraduates (NSF REU) and similar programs are welcome.

Mentor Programs

Cosponsored by the GSA Foundation. For more information, contact Jennifer Nocerino, jnocerino@geosociety.org.

Roy J. Shlemon Mentor Program in Applied Geoscience. Wed., 18 May, 11:45 a.m.–1:15 p.m., Riverwoods Conference Center, Maple Room. Students will have the opportunity to discuss career prospects and challenges with professional geoscientists from multiple disciplines over a FREE lunch. Learn more at www.geosociety.org/mentors/shlemon.htm.

John Mann Mentors in Applied Hydrogeology Program. 11:45 a.m.–1:15 p.m., Thurs., 19 May, Riverwoods Conference Center, Maple Room. This event gives students with an interest in applied hydrogeology or hydrology as a career an opportunity to interact and network with professionals over a FREE lunch. Learn more at www.geosociety.org/mentors/mann.htm.

Travel Grants

Deadline: 18 April

To qualify, (1) you must be a GSA student member; (2) you must be registered for the meeting before you can apply for a grant; and (3) you'll need to complete the online travel grant application form. Checks will be available for grant recipients to pick up at the meeting (in person, with photo ID). Learn more and access applications via links at **www.geosociety.org/sections/rm/** (Rocky Mountain Section) and **www.geosociety.org/sections/cord/travelGrants.htm** (Cordilleran Section).

CONTACT INFORMATION

Local Committee Co-Chair: John Shervais (Rocky Mountain), john.shervais@usu.edu, Utah State Univ., 4505 Old Main Hill, Logan, Utah 84322-4505, USA

Local Committee Co-Chair: Wendy Bohrson (Cordilleran), bohrson@geology.cwu.edu, Central Washington Univ., 400 E. University Way, Ellensburg, Washington 98926-7418, USA

Technical Program Co-Chair: Joel Pederson (Rocky Mountain), joel.pederson@usu.edu, 4505 Old Main Hill, Logan, Utah 84322-4505, USA

Technical Program Co-Chair: Lisa Ely (Cordilleran), ely@cwu.edu, Central Washington Univ., 400 E. University Way, Ellensburg, Washington 98926-7418, USA

GSA Today Science Editor Changes

David Fastovsky has signed off on his three and a half year term as science co-editor, which began in July 2007. Under Fastovsky's stewardship, the processing of *GSA Today* articles moved from an informal e-mail–based arrangement to an organized online manuscript tracking and review system. The *GSA Today* Groundwork article type also flourished during Fastovsky's tenure, and a new method for comment and reply publication was devised.

Fastovsky is a vertebrate paleontologist and chair of the Dept. of Geosciences at the University of Rhode Island. He is a GSA Fellow and the 2006 recipient of GSA's Distinguished Service Award, in recognition of his work as *Geology* editor from 1999 to 2005, service on numerous GSA committees, and his time as associate editor for *GSA Bulletin* (1996–2000). Learn more at www.uri.edu/cels/geo/GEO_Dfastovsky.html.

Fastovsky's research focuses on the evolution of Mesozoic terrestrial paleoenvironments, particularly those that contain dinosaurs and other terrestrial vertebrates. He notes, "Many paleobiological questions are uniquely addressed through geological means, and so for more than 25 years I have been studying the sedimentary geology of a variety of terrestrial settings—from the Triassic of Arizona, to the Cetaceous of Mongolia and Mexico, to the Cretaceous-Tertiary boundary in the upper Great Plains of the United States." Fastovsky is also a musician; a 2006 *Geotimes* article notes that "David Fastovsky has played the viola in some of the finest dinosaur fossil sites in the world…" (www.agiweb.org/geotimes/oct06/profiles.html; last accessed 29 Nov. 2010).

Bernard (Bernie) Housen, who stepped in as *GSA Today* science co-editor in July 2009, remains on the job through June 2013. He is professor and chair of the Geology Department at Western Washington University (WWU), and his main research focus is on Cordilleran tectonics and structure. In 2007, Housen and a multidisciplinary group of WWU faculty began development of the Advanced Materials Science and Engineering Center (AMSEC) there. Now in its third year, AMSEC is advancing its mission is to "educate students in materials science, support interdisciplinary research, and enhance regional industry competitiveness and innovation." Learn more at http://myweb.facstaff.wwu.edu/bernieh/.

As science co-editor, Housen is working to ensure that *GSA Today* remains a dynamic venue for the presentation of new research and synopses of important topics in the geosciences. He continues to draw on his interdisciplinary background to encourage articles that are both of value to specialists and of interest to professionals, educators, and the general *GSA Today* readership.

Signing on for 2011 is **R. Damian Nance,** Distinguished Professor of Geological Sciences at Ohio University, where he has taught since 1980. Nance brings a great deal of experience to *GSA Today*—along with his professorship at Ohio University, he has held visiting research positions at Louisiana State University, Oxford Brookes University, the Universidad Nacional Autónoma de México, and at St. Francis Xavier University as the W.F. James Professor of Pure and Applied Science. Nance has twice received Ohio University's College of Arts and Sciences Outstanding Teacher Award and serves as associate editor of *Gondwana Research* in addition to being *GSA Today's* new science co-editor.

In 1982, Nance, along with fellow department member Tom Worsley, proposed the supercontinent cycle, the now-substantiated theory that Earth's geologic, climatic, and biological evolution has been dominated by the episodic assembly and breakup of supercontinents. Nance's continued research interests include the origin and evolution of the Rheic Ocean and its role in the assembly of Pangea; late Precambrian–Paleozoic structural, kinematic, and tectonothermal evolution of the Acatlán and Granjeno complexes, Mexico, and the Avalon terrane in Maritime Canada; and Earth's long-term tectonic, geochemical, climatic, and biological history. Learn more at www.ohio.edu/geology/nance/.

GSA Today science editors are charged with obtaining first-class, focused articles that collectively reflect and summarize current topics and discoveries in the earth sciences. Science editors also solicit "Groundwork" articles, which are meant to further the influence of earth science on education, policy, planning, and funding. All submissions, whether solicited or volunteered, are peer reviewed. To submit a science or Groundwork article to *GSA Today*, please go to www.geosociety.org/pubs/gsatguid.htm for instructions and a link to our online manuscript tracking system.

THE GEOLOGICAL SOCIETY OF AMERICA®

SCIENCE ▪ STEWARDSHIP ▪ SERVICE

Welcome New GSA Members!

The following individuals submitted their applications for GSA membership between March and September 2010 and were approved by GSA Council at its fall 2010 meeting.

PROFESSIONALS

Yasser Medhat Abd El-Rahman
Mohamed Omar Abouelresh
Emilio Antonio Ahumada
Dan Aiken
Asma Mohamed Al-Ketbi
Richard T. Amos
William A. Anders
Fumiyasu Arakawa
Heather Emma Arends
Mónica Arias
Antonio Expedito Azevedo
Eric Baer
David Elliott Bailey
Marcos Soares Barbeitos
Rene W. Barendregt
Roswell Keith Barranco
Douglas J. Baumwirt
Sheryl Luzzadder Beach
Larry V. Benolkin
David C. Benson
William Marc Benzel
Pieter Berendsen
Frederic Besozzi
Zibonele Mhlaba Bhebhe
Noma Biggar
John Boast
Suama Nambashu Bolden
James W. Borchers
Mustapha Boujana
Catherine Bowman
Alexander Braun
Tammy K. Bravo
Christina Jo Brown
Cindy Burns
Robert G. Burns
William Lee Burns
Craig Allan Campbell
Kate Marie Campbell
Jessica E. Campbell-Murphy
Andrew Geddes Capes
Noelia Carmona
Janel Kay Carpenter
Michael J. Carroll
John Leonard Chambers
Stephen J. Champa
Stephen Cheung
Wu-Cheng Chi
Ashwini Kumar Choudhary
Sarah Christen
Jessica McDonough Ciosek
John Joseph Cipar
Michael K. Cobb
Lisa Ryan Coffey
Cristiano Collettini
Heather A. Collins
Peter Condon
Kathryn M. Conko
David Conner
Margo Danielle Corum
Claire M. Coyne
Shandra Craig
David Crawford
Dianna M. Crilley
Shane J. Csiki
Raymond C. Culotta
Jonathan A. Czuba
Cynthia Dacre
Samuel Boakye Dampare
Claude Daniel Danglot
Gary Thomas Dannemiller
Janel Day
Jason L. De Cristofaro
Mario G. De Freitas
F. Brett Denny
Jeffrey S. DeTienne
Maurice Deul
Fionnuala Devine
Robert K. Downing
Ruth Duerr
Alicia S. Dye
Yael Edelman-Furstenberg
Bradley Carl Edmison
Karen Lea Elliott
Scott Elrick
Mehmet Burak Emci
Steven H. Emerman
Cintia R. Emery
Joan S. Esterle
Paula Frost Even
John Robert Faba
Paul Falkowski
John J. Farber
Kristina Faul
Richard Alan Feely
Vince L. Felt
Alejandro Fernandez-Martinez
Judson Byrd Finley
Baruch Fischhoff
Eugene P. Fisher
John R. Forster
Lucja Fostowicz-Frelik
Gillian Rose Foulger
Leigh Franks
Michael Freiheiter
Hirokazu Fujimaki
David W. Gallaher
Mladen Garasic
Phil A. Gensler
Nicholas Gianoutsos
Jeffrey J. Gillis-Davis
Adam Matthew Gilmore
Cynthia Gilmour
John Giorgi
Frank Stuart Glass
Sabrina Claire Golay
Leila M. Gonzales
Robert Goodhue
Brian Scott Goodman
Richard Greenberg
Stephen Gridley
Brenda Faye Griffin
Eleanor R. Griffin
Mark Kenichi Gross
Amber R. Grzymski
Evan Gulling
Michael Gunderson
Harold Gurrola
John B. Gustavson
Marilyn S. Hajicek
Terry Lee Hamrick Jr.
Evan Hart
Martin Hassellöv
Benjamin D. Haugen
Jonathan A. Haws
Jason J. Head
Christian Heine
Elizabeth Helton
Tom Wax Hill
Dorothee Hippler
Arthur B. Hobbs
James D. Hodge
Thomas Frank Hoffman
Thomas Ethan Howes
Jon Hronsky
Xiumian Hu
Hao-Jen Huang
Philip Hughes
Mark Edward Hulett
Danielle M. Huminicki
James Ronald Humphrey
Chang Bock Im
Pervaiz Iqbal
Timothy Ireland
Linda Jacobsen
Peter R. Jaffe
Je-Hun Jang
Ghaleb H.K. Jarrar
Shelley Jaye
Chris J. Jenkins
Bruce Dale Johnson
Christopher L. Johnson
James Roger Johnson
William David Johnson
Alison H. Jones
Caroline M. Jonsson
Young-Shin Jun
Niko Jan Kampman
B. Keith Kaneda
Leonard J. Karr II
Jaswant S. Kathait
George Richard Kear
Kyle Vincent Keator
Waqas Khalid Khokher
Kyu Han Kim
Gregory G. Kipp
Carl S. Kirby
Shiloh L. Kirkland
Kim B. Knight
Michael Knight
Mike Knoper
Michael Helmut Kobler IV
Allan J. Koch
Karen Elizabeth Kohfeld
Alan Stanley Kornacki
David P. Krabbenhoft
Mark Otto Kruger
Timothy Kusky
Michael Lacey
Lisa Marie LaFlame
Malcolm Arthur Lamb
James Wood LaMoreaux
Michael Landsman
Norman H. Lazarus
Dennis Cody Lees
Lynsey E. LeMay
Mary E. Lennon
Shannon Leslie
Jun Li
Sanzhong Li
Delberta "Birdie" Lipscomb
Kelly Liu
Mark S. Lober
Suzanna Long
Gregory Lowry
Isaac Yimonkpa Mabee
Kristine Y. Macaluso
Janet Manchester
Craig R. Manker
Craig Patrick Marshall

Patricia Gallagher Mason
Earl D. Mattson
Norihumi Matushita
David Mays
Carol M. McAdams
Thomas B. McCord
Mack McGillivray
Molly M. McGuire
Anna McIntyre-Wressnig
James G. McLaughlin
Paul McNeill
Norman Caston Meyer
Louise Irene Miltich Segroves
Donald Miser
Victor I. Mocanu
Thomas Monecke
John N. Monroe Jr.
Kallie Moore
Hector Mora-Paez
Siobahn Morgan
John Morrone
Jennifer Bauer Morton
Robert Moucha
Roberto A. Munoz
Kyle Edward Murray
N. Nagesh
Pritam Nasipuri
Steven M. Nelson
Steven R. Newkirk
Gregory L. Neyman
Gene-Hua Crystal Ng
Stefan Nielsen
Alan G. Nunns
Eric G. Ober
Michael O'Donnell
Robert H. Oldfield
Richard Edward Oliver
Richard A. Olsen
Ramon Dagoberto Orozco
Teresa Orozco-Esquivel
Anthony L. Ortmann
David L. Parkhurst
Rosann E. Park-Jones
Terri Lynne Patton
Keith Andrew Payne
Christa J. Placzek
Elia Pliego Vidal
Jason Philip Pope
Matthew O'Bryhim Porter
Michael George Povey
Alden Provost
Carol Jane Ptacek
Phillip Lloyd Pumphrey
Scott Purcifull
Leonardo Ramirez-Guzman
Birger Rasmussen
Moumtaz Razack
Joel D. Reed
Gene M. Renard
Mahnaz Rezaeian
Bryony Gail Richards
Thomas R. Richardson
Anthony N. Rios
Mohammad Rizki
Derrick R. Rodriguez
David Rowlands
Sandip Kumar Roy
Xiaoyan Ruan
Jenni Rush
Robert Sadownyk
Raymond Christopher Salmon
Mototaka Saneysohi
Shuxun Sang
John William Sauri
Brennon John Schaefer
Thomas D. Scheiwe
Anja Maria Schleicher
Janet A. Schramke
Vera Schulte-Pelkum
Alisa Ann Scott
Eric Scott
John Edward Sebastian
Jacob Sewall
K. C. Sharma
Alexander Iain Shaw
Roy C. Sidle
Luc Emile Siebenaller
Malcolm Siegel
Bruce Siegmund
Steven Singletary
Francisco Javier Sinisterra
Jason Sitchler
Emmanuel Skourtsos
David V. Smith
Gerardo A. Smith
Rani Kottiath Smith
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GSA ELECTIONS

GSA's success depends on you—its members—and the work of the officers serving on GSA's Executive Committee and Council.

In early March, you will receive a postcard with instructions for accessing your electronic ballot via our secure website; biographical information on the nominees will be online for you to review at that time. Paper versions of both the ballot and candidate information will also be available.

Please help shape GSA's future by voting on the nominees listed here.

2011 Officer and Council Nominees

PRESIDENT
(July 2011–June 2012)
John W. Geissman
University of New Mexico
Albuquerque, New Mexico, USA

VICE PRESIDENT
(July 2011–June 2012)
George H. Davis
University of Arizona
Tucson, Arizona, USA

TREASURER
(July 2011–June 2012)
Jonathan G. Price
Nevada Bureau of Mines & Geology
Reno, Nevada, USA

Councilor Position 1
(July 2011–June 2015)
Harvey Thorleifson
University of Minnesota
Minneapolis, Minnesota, USA
Janet S. Herman
University of Virginia
Charlottesville, Virginia, USA

COUNCILOR POSITION 2
(July 2011–June 2015)
Laura F. Serpa
University of Texas at El Paso
El Paso, Texas, USA
Robert J. Tracy
Virginia Polytechnic Institute
and State University
Blacksburg, Virginia, USA

COUNCILOR POSITION 3
(July 2011–June 2015)
Russell S. Harmon
U.S. Army Research Office–Environmental
Science Division
Research Triangle Park, North Carolina, USA
John M. Holbrook
University of Texas at Arlington
Arlington, Texas, USA

Ballots accepted beginning 10 March 2011
Ballots due electronically or postmarked by 9 April 2011

Donna L. Russell, *Director of Operations*

Funding Student Research as Global as Our Science

GSA Research Grants—International Program

GSA has initiated a non-North American–based Graduate Student Research Grants Program to include GSA's international student members. We are asking for your help with the funding of this exciting new program.

The current North American program is one of the largest and most prestigious funding programs for geoscience graduate students in this arena. The program helps fund the field and laboratory costs of geoscience projects conducted by master's and doctoral students at universities in the United States, Canada, Mexico, and Central America. Since its inception in 1933, GSA has awarded over US$11.6 million to almost 10,000 students. This program is an essential element in supporting the education and training of future geoscientists while instilling in our student members a sense of loyalty to the Society.

In order to initiate the GSA Research Grants—International Program in the near future, we need to build its funds. You can contribute in two ways:

1. Send your check payable to the GSA Foundation to P.O. Box 9140, Boulder, CO 80301, USA. Please note on the memo line that your donation is for "GSA Research Grants—International Program."
2. Go to the GSA Foundation's website (gsafweb.org) and click on the "Make a Donation" tab at the top-center of the page. Enter the amount of your donation and select "GSA Research Grants—International Program" from the pull-down menu.

We thank you in advance for your interest in growing GSA's support of student research.

Most memorable early geologic experience:

Collecting Tigris and Euphrates sediment samples in Iraq in the 1960s, surrounded by archaeological sites of great antiquity, not to mention some curious Bedouins.

—Richard W. Berry

GeoTales on the Web

Announcing an exciting new way to enjoy *GeoTales*: Online! In addition to *GeoTales* booklets volumes 1–4, we have created a section on the Foundation's website for never-before published stories. Please go to gsafweb.org/geotales/ to read these additional new adventures submitted by GSA members.

For each gift to the Foundation of US$50 or more, you may select one complimentary copy of *GeoTales* as a token of our appreciation.

Support GSA Programs

Donate now!

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1. **Enclosed is my contribution in the amount of $_____**
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Donate online at **www.gsafweb.org**

2010 OEST AWARD RECIPIENTS NAMED

The National Association of Geoscience Teachers (NAGT) has announced its 2010 Outstanding Earth Science Teacher (OEST) Award recipients. For details, go to **www.geosociety.org/awards/oest.htm.**

GSA Congratulates These Outstanding Earth Science Teachers!

SECTION AWARDEES

Central Section:
De Anna Tibben,
Ames High School,
Ames, Iowa, USA

Eastern Section:
Heather H. McArdle,
Mahopac High School,
Mahopac, New York, USA

Far Western Section:
Nick Crooker,
Modesto High School,
Modesto, California, USA

New England Section:
Jennifer Judkins,
Wilmington Middle School,
Wilmington, Massachusetts, USA

Pacific Northwest Section:
Chris Hedeen,
Oregon City High School,
Oregon City, Oregon, USA

Southeastern Section:
Bryan Freeman,
Clinton High School,
Clinton, Tennessee, USA

Southwestern Section:
Laura Lukes,
Saguaro High School,
Scottsdale, Arizona, USA

STATE AWARDEES

Alabama: Kim Ouderkirk, Tuscaloosa

Alaska: David Gillam, Nicholas J. Begich Middle School, Anchorage

Florida: Minerva Santerre, Frank C. Martin K–8, Miami

Georgia: Michael McClain, Powder Springs

Indiana: Mark Ruckert

Iowa: De Anna Tibben, Ames High School, Ames

Louisiana: Chris Campbell, Ruston

Maryland: Mona Becker, Sykesville Middle School, Sykesville

Minnesota: Kate Rosok, Edison High School, Minneapolis

Mississippi: Brittany Brewer, Diamondhead

New Jersey: Peter Dorofy, Burlington County Institute of Technology, Medford

New York: Heather McArdle, Mahopac High School, Mahopac

North Carolina: Joshua David Roberts, Durham

Oregon: Mike Rockow, Leslie Middle School, Salem

Pennsylvania: Karen Aucker, Jersey Shore Area Senior High, Jersey Shore

South Carolina: Jeanne Hartley, Lexington Middle School, Lexington

Tennessee: Bryan E. Freeman, Clinton High School, Clinton

Washington: Kareen Border, Key Peninsula Middle School, Lakebay

West Virginia: Andrea Anderson, Weirton High School, Weirton

CALL FOR PAPERS

The goal of the *GSA Today* "Groundwork" series is to *lay the groundwork* for furthering the influence of earth science on education, policy, planning, and funding. Articles can include in-depth geoscience commentary, short observations and analysis of hot topics, and discussion of policy news and issues.

Characteristics of a "Groundwork" Article:

1. This should be a complete, stand-alone article (ongoing or serial commentary or meetings summaries are not appropriate).
2. If authors have supplemental information, they may include it as an online GSA Supplemental Data item.
3. Articles must be *no longer than* 1,400 words with two small figures or 1,600 words with one figure (which equals two typeset pages in *GSA Today*).
4. Color figures may be included at no cost to authors.
5. *GSA Today* science editors are responsible for review and acceptance of the articles (all are peer-reviewed), as well as guiding authors regarding *GSA Today* standards.
6. Articles will be published on a space-available basis after acceptance.

Learn more and submit a manuscript at

www.geosociety.org/pubs/gsatguid.htm.

SAVE $ by registering early!

2011 GSA Section Meetings

Be a part of the geoscience action with ***GSA's spring meetings!***

Pittsburgh, Pennsylvania, USA. Photo courtesy Greater Pittsburgh Chamber of Commerce.

NORTHEASTERN/NORTH-CENTRAL Joint Meeting

20–22 March 2011 • Pittsburgh, Pennsylvania, USA

Pittsburgh is built around the confluence of the Monongahela and Allegheny Rivers, which join in the city to form the Ohio River. This area offers a variety of geologically interesting venues, including excellent examples of the Allegheny Front separating the Valley and Ridge and Appalachian Plateau Provinces.

Early registration deadline: 14 February

Grandfather Mountain; image courtesy North Carolina Tourism.

SOUTHEASTERN

23–25 March 2011 • Wilmington, North Carolina, USA

This meeting will follow the theme "Exploration to Exploitation: Geosciences' Role in Natural Resource Stewardship" and will be held at the new Wilmington Convention Center on the banks of the scenic Cape Fear River, just minutes from the scenic North Carolina coast.

Early registration deadline: 22 February

SOUTH-CENTRAL

27–29 March 2011 • New Orleans, Louisiana, USA

Headquarters for this meeting will be at the historic Chateau Bourbon hotel in New Orleans' French Quarter, within easy walking distance of the winding Natchez River. Field trips will assess the impacts of Hurricane Katrina, investigate the effects of sea-level rise on the Louisiana coastal plain, and explore the Cane Bayou by canoe.

Early registration deadline: 22 February

New Orleans cityscape, 2007; photo courtesy New Orleans Convention and Visitors Bureau.

ROCKY MOUNTAIN/CORDILLERAN Joint Meeting

18–20 May 2011 • Logan, Utah, USA

Logan is located at a nexus of western geology, with the Rocky Mountains to the east, the Basin and Range to the west, and the Snake River Plain to the north. Geologic formations near Logan range in age from paleo-Proterozoic to Quaternary and in character from crystalline to karst.

Early registration deadline: 18 April

Old Main on the Utah State University Campus, with the stunning Wellsville Mountains in the background. Photo by Donna Barry.

Find more meeting information at **www.geosociety.org/meetings/** and look for your meeting brochures in the mail.

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NOTICE
of Spring 2011 GSA Council Meeting

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

Council will meet next on Friday, 29 April, 1–4:30 p.m.; Saturday, 30 April, 8 a.m.–noon; and Monday, 2 May, 8 a.m.–noon. The GSA corporate meeting will be Friday, 29 April, 4:30–5 p.m. Meeting location: TBA.

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FUNDING for GSA's Research Grants Program

In 1933, R.V. Anderson received the first Geological Society of America research grant, using it to study the geology of the coastal Atlas Mountains in western Algeria. Seventy-seven years later, GSA's Research Grants Program is still growing and providing students with much-needed funding.

The **GEOSTAR** fund, created in 1987, augments the Research Grants Program. Contributions to GEOSTAR from individuals, industry, and institutions are vital—you can help support a young geoscientist's future by donating today.

Send your check to the GSA Foundation, 3300 Penrose Place, Boulder, CO 80301, USA; call +1-303-357-1054; or donate online at **gsafweb.org.**

GEOSTAR
Supporting The Advancement of Research

Philmont Scout Ranch Volunteer Geologist Program

Cimarron, New Mexico, USA

Sponsored by the Rocky Mountain Association of Geologists

Volunteer to teach and demonstrate area geology in back-country New Mexico!

Philmont Scout Ranch is one of three national high-adventure bases owned and operated by the Boy Scouts of America. Located in the southern Sangre de Cristo Mountains of northern New Mexico, Philmont is a 137,000 acre ranch dedicated to outdoor activities. The twelve-day backpacking experience serves over 21,000 high-school-age boys and girls from all over the USA as well as several foreign countries.

Fifty-four positions are open again this year, to be filled on a first-come, first-served basis. Volunteers will receive a sign-up packet with scout applications (you have to be a scout, at least for the summer!), medical forms, and brochures in May 2011. Students who would like to volunteer must show proof of enrollment in a graduate-level program.

The 2011 season begins on Sunday, 12 June; 8 August begins the last week of the program.

For more information and to sign up, contact Ed Warner, P.O. Box 480046, Denver, CO 80248-0046, USA, +1-720-904-0560, ewarn@ix.netcom.com. Alternate contact: Bob Horning, P.O. Box 460, Tesuque, NM 87575, USA, +1-505-820-9290, rrhorning@gmail.com.

Learn more about the geology of the area at http://pubs.usgs.gov/pp/pp_505/html/pdf.html.

Quick Reference

GSA News & Information on the Web

More news about GSA members:
www.geosociety.org/news/memberNews.htm

Information about current, past, and future GSA meetings:
www.geosociety.org/meetings/

Dates and information about other geoscience-related meetings:
www.geosociety.org/calendar/

Resources for K–12 earth science educators:
www.geosociety.org/educate/resources.htm

Find your science at GSA:
www.geosociety.org/themes/

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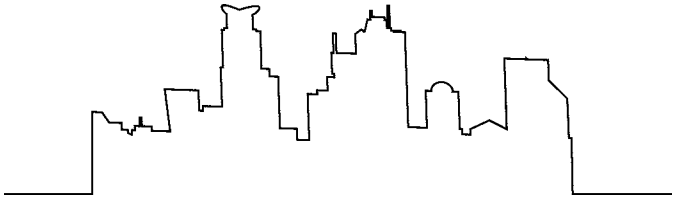

GSA ANNUAL MEETINGS LOOK TOWARD THE FUTURE

2011
Minneapolis, Minnesota, USA
(9–12 October)

2012
Charlotte, North Carolina, USA
(4–7 November)

2013—125TH ANNIVERSARY OF GSA!
Denver, Colorado, USA
(27–30 October)

2014
Vancouver, British Columbia, Canada
(19–22 October)

2015
Baltimore, Maryland, USA
(1–4 November)

Classified Rates—2011

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Classification	Per Line for 1st month	Per line each addt'l month (same ad)
Positions Open	$8.90	$8.65
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Positions Open

DIRECTOR, NEPTUNE CANADA
OCEAN NETWORKS CANADA AT
THE UNIVERSITY OF VICTORIA

Location: Victoria, British Columbia Date posted: 4 Jan. 2011

Ocean Networks Canada (ONC) invites applications for the position of Director, NEPTUNE Canada. The position is for an initial five year term and is renewable subject to funding. This world-leading cabled ocean observatory began operations in 2009, delivering real time data to researchers around the world from the seafloor on the coastal margins of Vancouver Island to the deep ocean at the Juan de Fuca Ridge. NEPTUNE Canada represents a capital investment of $130M, with a $12M annual O&M budget. The 40 dedicated staff of scientists, engineers, data management specialists, and administrators maintain the subsea facility, the data archive and design new approaches to ocean data collection, management and distribution in partnership with the large scientific user community.

The Director's duties include

- responsibility for overall leadership, advocacy and management of the observatory;
- leadership in building the Canadian and international user community;
- promotion of the role of ocean observation in under standing earth systems;
- strategic planning for maintaining excellence, future development and funding of the observatory; and
- support for the vision of ONC in areas of ocean policy, outreach and private sector engagement.

With NEPTUNE Canada transitioning from its installation to operational phase, an exciting opportunity exists for the next Director to catalyze further development of the dynamic research environment in ocean sciences. ONC is seeking a visionary leader, a recognized researcher, an experienced project manager, a team builder, and a steward of science. ONC was created in 2007 by the University of Victoria to oversee the governance and management of the NEPTUNE Canada and VENUS cabled ocean observatories. The NEPTUNE Canada Director reports to the ONC President and CEO and will normally be eligible for an academic appointment at the University of Victoria.

The successful candidate will have an extensive background in a relevant science discipline, including an excellent research track record and strong ties with the international community. The individual will be an accomplished leader, with a strong managerial and research track record. Excellent interpersonal, problem-solving and communication skills are essential as well as superior skills in administration and organizational leadership and project management.

Applications should include a statement of relevant experience and accomplishments, a full CV, and a list of four referees. **Review of candidates will begin by 15 Feb. 2011**; the appointment of the Director will begin on 1 July 2011 or as mutually agreed.

The position description and details about ONC, NEPTUNE Canada and the University of Victoria can be found at www.oceannetworks.ca and www.neptunecanada.ca. For more information, please contact Martin Taylor (onet@uvic.ca).

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. The University of Victoria hires on the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and Aboriginal persons.

FACULTY POSITIONS
HYDROGEOLOGY AND PETROLOGY
AUSTIN PEAY STATE UNIVERSITY

The Department of Geosciences at Austin Peay State University, Tennessee, invites applications for two tenure-track positions at the Assistant Professor level beginning Fall 2011. One position is for Igneous/Metamorphic Petrology-Mineralogy and the other is Hydrogeology-Low Temperature Geochemistry. Details about the position and how to apply can be found at www.apsu.edu/human-resources/faculty/currentjobopenings. Information about the department can be found at www.apsu.edu/geosciences.

PETROLEUM TECHNOLOGY
INSTRUCTOR/ASSISTANT PROFESSOR
UNIVERSITY OF PITTSBURGH AT BRADFORD

Petroleum Technology (Instructor/Assistant Professor), non-tenure stream, beginning Fall 2011. Requirements: B.S. (higher degree preferred) with considerable oil and gas industry field experience. Job duties include teaching courses in Petroleum Technology and related courses such as Drilling and Completion, Gathering and Transportation, Petroleum Geology & Geophysics, and Environment & Safety. Submit letter of application, C.V., statement of teaching philosophy (a statement of experience working with students of diverse backgrounds is encouraged), and three letters of recommendation to Dr. Assad Panah (aap@ptt.edu), Search Committee Chair, University of Pittsburgh at Bradford, 300 Campus Drive, Bradford, PA 16701 (www.upb.pitt.edu/acadsearch.aspx). Review of completed applications will begin 15 Feb. 2011, and continue until position is filled. Pitt-Bradford is a beautiful, friendly campus with an emphasis on teaching. While faculty have the advantage of the expansive resources and research opportunities available through the University of Pittsburgh system, they also enjoy one-on-one contact with their students in a secure, personalized environment. Individuals representing all aspects of diversity are encouraged to apply. AA/EOE.

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Coming to *GSA Today* in 2011

Science Articles

March: G. Shields-Zhou and L. Och, "The emergence of a more oxygenated earth system during the Neoproterozoic: Geochemical evidence, biological consequences, and future changes"

April/May: P. Kapp, J.D. Pelletier, A. Rohrmann, R. Heermance, J. Russell, and Lin Ding, "Wind erosion in the Qaidam basin, central Asia: Implications for tectonics, paleoclimate, and the source of the Loess plateau"

In the queue: P. Hammer, R. Clowes, F. Cook, K. Vasudevan, and A. van der Velden, "The big picture: A lithospheric cross-section of the North American continent"

In the queue: P. Reiners, C. Riihimaki, and E. Heffern, "Clinker geochronology, Plio-Pleistocene glaciation, and landscape evolution in the northern Rockies"

Groundwork articles:

In the queue: S. O'Connell and M.A. Holmes, "Obstacles to the recruitment of minorities into the geosciences"

In the queue: J. Libarkin, E.G. Ward, S. Anderson, G. Kortemeyer, and S. Raeburn, "Revisiting the geoscience concept inventory: A call to the community"

GSA Today articles from 1995 on are open access via link at **www.geosociety.org/pubs/.**

Publications Highlights

Geology Gets to Work at E&EG

Environmental & Engineering Geoscience seeks contributions in the broadly defined areas of environmental and engineering geosciences, including geomorphology, hydrogeology, low-temperature geochemistry, neotectonics, and other earth-surface processes.

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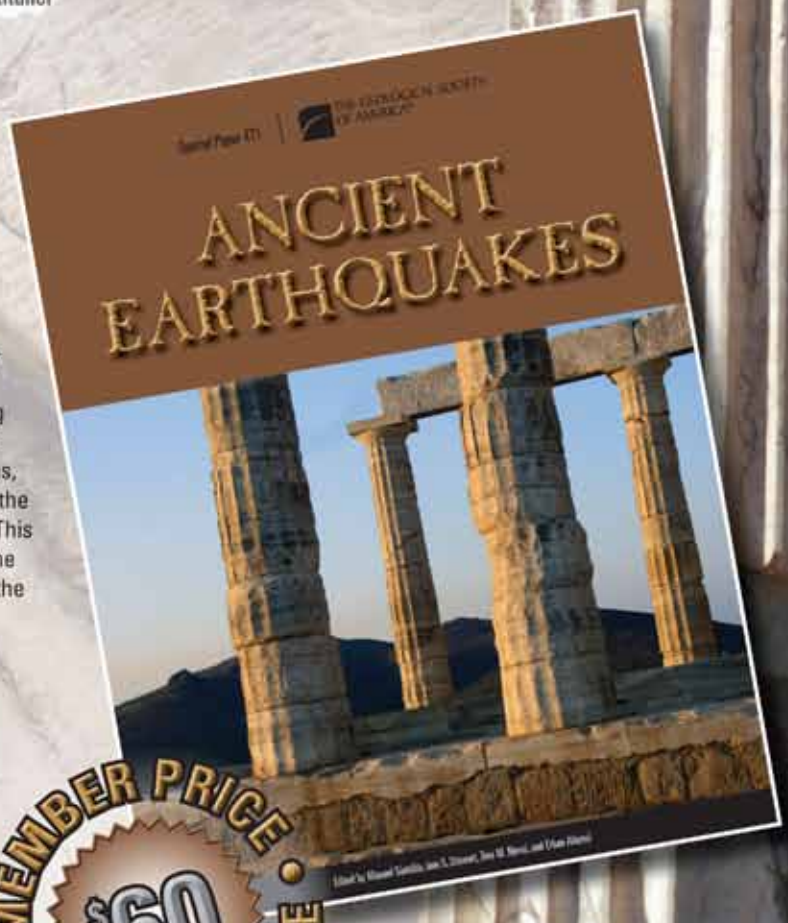
Special Paper 471

ANCIENT EARTHQUAKES

Edited by Manuel Sintubin, Iain S. Stewart, Tina M. Niemi, and Erhan Altunel

Ancient earthquakes are pre-instrumental earthquakes that can only be identified through indirect evidence in the archaeological (archaeoseismology) and geological (paleoseismology) record. Special Paper 471 includes a selection of cases convincingly illustrating the different ways the archaeological record is used in earthquake studies. The first series of papers focuses on the relationship between human prehistory and tectonically active environments, and on the wide range of societal responses to historically known earthquakes. The bulk of papers concerns archaeoseismology, showing the diversity of approaches, the wide range of disciplines involved, and its potential to contribute to a better understanding of earthquake history. *Ancient Earthquakes* will be of interest to the broad community of earth scientists, seismologists, historians, and archaeologists active in and around archaeological sites in the many regions around the world threatened by seismic hazards. This Special Paper frames in the International Geoscience Programme IGCP 567, "Earthquake Archaeology: Archaeoseismology along the Alpine-Himalayan Seismic Zone."

SPE471, 279 p., ISBN 9780813724713 | list price $85.00 | **member price $60.00**



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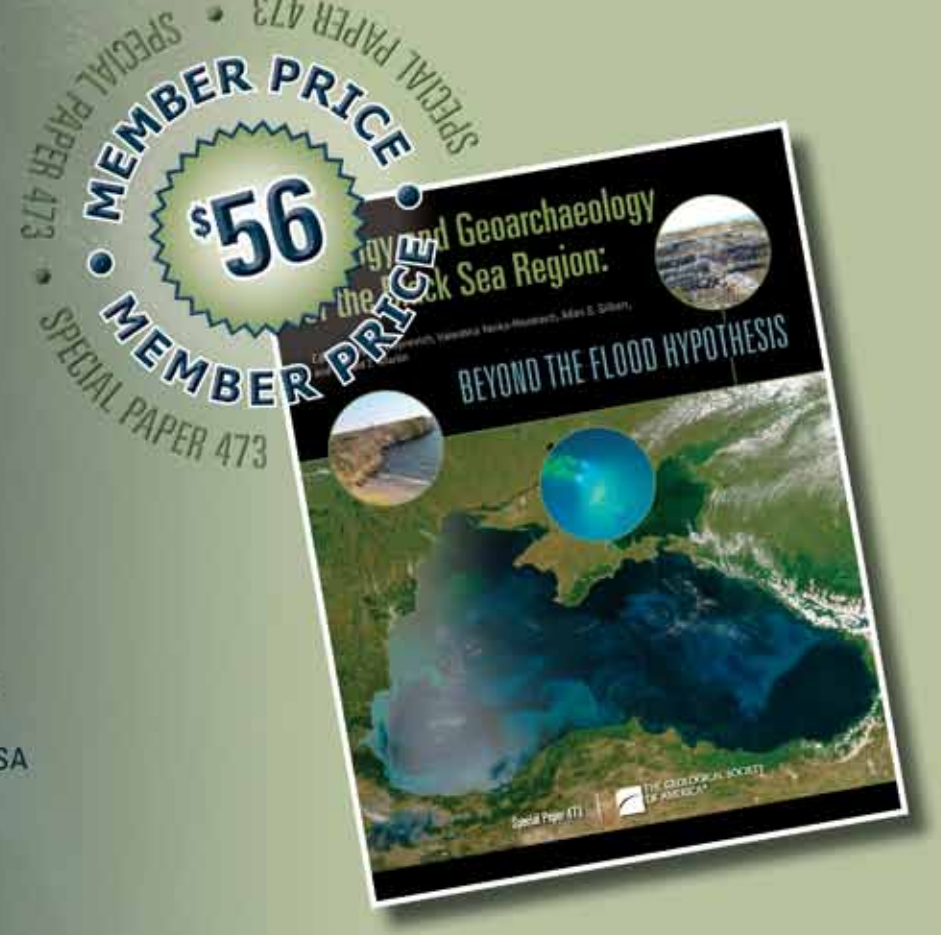
Geology and Geoarchaeology of the Black Sea Region:

Edited by Ilya V. Buynevich, Valentina Yanko-Hombach, Allan S. Gilbert, and Ronald E. Martin

BEYOND THE FLOOD HYPOTHESIS

Contributors from twelve countries wrote the twelve chapters in this Special Paper, and they address a range of topics, including climatic and hydrologic modeling, paleogeographic reconstruction of Late Quaternary landscapes, palynology and paleoclimate reconstruction, and geoarchaeological studies, both onshore and offshore. The volume serves as a timely reference for continuing research in a region harboring a number of newly independent states that are now faced with population pressure and a variety of environmental issues.

SPE473, 196 p., ISBN 9780813724737 | $80.00 | **member price $56.00**



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