

# GSA TODAY

VOL. 18, No. 12

A PUBLICATION OF THE GEOLOGICAL SOCIETY OF AMERICA

DECEMBER 2008

## The Rheic Ocean: Origin, Evolution, and Significance

### **Inside:**

**Upcoming Award, Recognition  
& Grant Deadlines, p. 16**

**GSA Adopts New Strategic Plan, p. 18**

### **Section Meetings:**

**Cordilleran Section, p. 24**

**South-Central Section, p. 26**



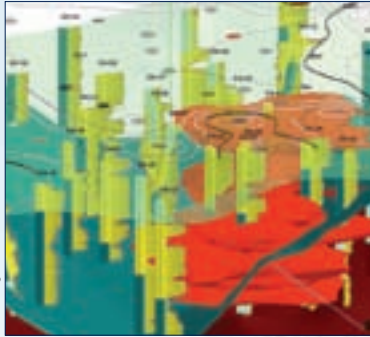
# It's Not Just Software... It's RockWare.

For Over 24 Years.

## RockWorks™

3D Data Management, Analysis & Visualization

- Powerful measured-section/borehole database for managing:
  - Lithology - Stratigraphy
  - Hydrology - Fractures
  - Hydrochemistry (e.g. Contaminants)
  - Geophysics - ... and more
- Create striplogs, cross-sections, fence diagrams, and block models.
- Contour data in 2D and 3D (isosurfaces).
- Extensive on-line help and sample data sets.
- Includes RockWorks Utilities



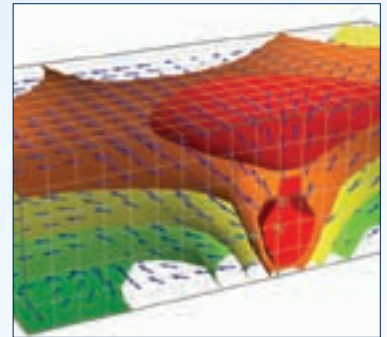
Free trial available at [www.rockware.com](http://www.rockware.com).

**\$2,499 Commercial/\$899 Academic**

## PetraSim™

A Preprocessor and Postprocessor for TOUGH2, T2VOC, TMVOC & TOUGHREACT, TOUGH-FX/HYDRATE, and TETRAD

- Model multi-component fluid flow, heat transfer and reactive transport process
- Saturated and unsaturated conditions
- Fractured and porous media
- Mesh generation, parameter definition, and display of results

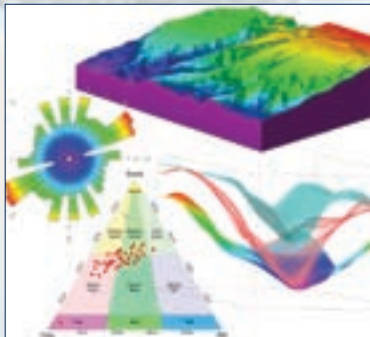


**Call for pricing**

## RockWorks Utilities™

An Indispensable Collection of Modeling, Analysis, and Display Tools

- Point maps
- Contour maps
- 3D surfaces
- Gridding tools
- Solid models
- Volumetrics
- Piper/Stiff plots
- Rose & Stereonet diagrams



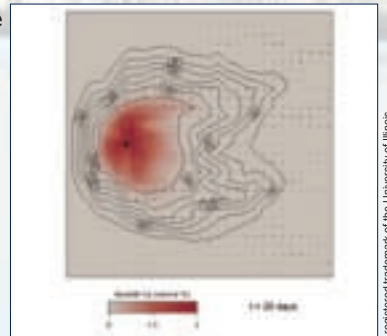
Free trial available at [www.rockware.com](http://www.rockware.com).

**\$599**

## The Geochemist's Workbench™

GWB is the premiere software solution for simulation of:

- Scaling
- Souring
- Flooding
- Formation damage
- Frac jobs
- Fluid compatibility



GWB Standard  
Reaction Path Modeling

**\$3,499**

GWB Professional  
1D/2D Reactive Transport Modeling

**\$7,999**

The Geochemist's Workbench® is a registered trademark of the University of Illinois.



Since 1983

303.278.3534 • 800.775.6745

[RockWare.com](http://RockWare.com)

*GSA TODAY* publishes news and information for more than 21,500 GSA members and subscribing libraries. *GSA TODAY* (ISSN 1052-5173 USPS 0456-530) is published 11 times per year, monthly, with a combined April/May issue, by The Geological Society of America®, Inc., with offices at 3300 Penrose Place, Boulder, Colorado. Mailing address: P.O. Box 9140, Boulder, CO 80301-9140, USA. Periodicals postage paid at Boulder, Colorado, and at additional mailing offices. Postmaster: Send address changes to *GSA Today*, GSA Sales and Service, P.O. Box 9140, Boulder, CO 80301-9140. GSA provides this and other forums for the presentation of diverse opinions and positions by scientists worldwide, regardless of their race, citizenship, gender, religion, or political viewpoint. Opinions presented in this publication do not reflect official positions of the Society.

Copyright © 2008, The Geological Society of America (GSA). All rights reserved. Copyright not claimed on content prepared wholly by U.S. government employees within scope of their employment. Individual scientists are hereby granted permission, without fees or further requests to GSA, to use a single figure, a single table, and/or a brief paragraph of text in other subsequent works and to make unlimited photocopies of items in this journal for noncommercial use in classrooms to further education and science. For any other use, contact Permissions, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA, Fax +1-303-357-1073, [editing@geosociety.org](mailto:editing@geosociety.org).

**SUBSCRIPTIONS** for 2008 calendar year: Society Members: *GSA Today* is provided as part of membership dues. Contact GSA Sales and Service at +1-888-443-4472, +1-303-357-1000, option 3, or [gsaservice@geosociety.org](mailto:gsaservice@geosociety.org) for membership information. Nonmembers & Institutions: Free with paid subscription to both *GSA Bulletin* and *Geology*, otherwise US\$60. Contact Subscription Services at +1-800-627-0629 or [gsa@allenpress.com](mailto:gsa@allenpress.com). Also available on an annual CD-ROM (with GSA's journals, GSA Data Repository, and an Electronic Retrospective Index to journal articles from 1972); US\$99 to GSA Members, others call GSA Subscription Services for prices and details. Claims: For nonreceipt or for damaged copies, members contact GSA Sales and Service; all others contact Subscription Services. Claims are honored for one year; please allow sufficient delivery time for overseas copies, up to six months.

**GSA TODAY STAFF:**

**Executive Director and Publisher:** John W. Hess  
**Science Editors:** Stephen T. Johnston, University of Victoria, School of Earth & Ocean Sciences, Victoria, British Columbia V8W 3P6, Canada, [stj@uvic.ca](mailto:stj@uvic.ca); and David E. Fastovsky, University of Rhode Island, Department of Geosciences, Woodward Hall, Rm. 317, Kingston, Rhode Island 02881, USA, [defastov@uri.edu](mailto:defastov@uri.edu).  
**Managing Editor:** Kristen E. Asmus, [kasmus@geosociety.org](mailto:kasmus@geosociety.org)  
**Graphics Production:** Margo Y. Sajban

**ADVERTISING:**

**Classifieds & Display:** Ann Crawford, +1-800-472-1988, ext. 1053, +1-303-357-1053, Fax +1-303-357-1070; [acrawford@geosociety.org](mailto:acrawford@geosociety.org)

**GSA ONLINE:** [www.geosociety.org](http://www.geosociety.org)

Printed in the USA using pure soy inks.

4 **The Rheic Ocean:  
Origin, Evolution, and Significance**

R. Damian Nance and Ulf Linnemann

**Cover:** Recumbent chevron folds in Early Pennsylvanian graywacke and shale of the Bude Formation at Millook Haven on the north coast of Cornwall, southwestern Britain, record the development and deformation of the Variscan foreland basin—testifying to the closure of the Rheic Ocean during the mid- to Late Pennsylvanian Variscan orogeny. See “The Rheic Ocean: Origin, Evolution, and Significance” by R.D. Nance and U. Linnemann, p. 4–12.



13 **Letter**

14 **Call for Nominations:** 2009 GSA Division Awards

15 **Call for Applications:** 2009–2010 GSA-USGS Congressional Science Fellowship

16 **Upcoming Award, Recognition & Grant Deadlines**

18 **GSA Adopts New Strategic Plan**

22 **Call for Proposals:** 2009 GSA Annual Meeting, “From Volcanoes to Vineyards: Living with Dynamic Landscapes”

24 **2009 GSA Section Meeting Calendar**

24 **Preliminary Announcement and Call for Papers:** Cordilleran Section Meeting

25 **2009 GSA Section Meeting Mentor Programs**

26 **Final Announcement and Call for Papers:** South-Central Section Meeting

28 **GSA Foundation Update**

29 **About People and In Memoriam**

31 **Classified Advertising**

39 **Journal Highlights and Coming Soon to *GSA Today***

**Erratum**

The August *GSA Today* (v. 18, no. 8, p. 17) included periods with the initials “W J” for William John McGee. According to two GSA Fellows, “in later years,” McGee preferred his first and middle names to be represented by initials only, with no periods.

*We’d like to hear from you:* Information like that provided by these two GSA Fellows is invaluable to accuracy and the preservation of Society history — if you see errors in *GSA Today*, please contact the managing editor at [kasmus@geosociety.org](mailto:kasmus@geosociety.org) so that we can make the correction and set the record straight! Thanks.

# The Rheic Ocean: Origin, Evolution, and Significance

**R. Damian Nance**, Department of Geological Sciences, 316 Clippinger Laboratories, Ohio University, Athens, Ohio 45701, USA, nance@ohio.edu; **Ulf Linnemann**, Staatliche Naturhistorische Sammlungen Dresden, Museum für Mineralogie und Geologie, Königsbrücker Landstraße 159, D-01109 Dresden, Germany

that played the dominant role in creating the Appalachian-Ouachita orogen, and an important record of its history may be preserved in Mexico.

## INTRODUCTION

The Rheic Ocean—named for the Titan, Rhea, sister to Iapetus in Greek mythology—is arguably the most important ocean of the Paleozoic. Following the Silurian closure of the Iapetus Ocean, the Rheic Ocean separated the major paleocontinents

## ABSTRACT

The Rheic Ocean, which separated Laurussia from Gondwana after the closure of Iapetus, was one of the principal oceans of the Paleozoic. Its suture extends over 10,000 km from Middle America to Eastern Europe, and its closure assembled the greater part of Pangea with the formation of the Ouachita-Alleghanian-Variscan orogen.

The Rheic Ocean opened in the Early Ordovician, following protracted Cambrian rifting that represented a continuum of Neoproterozoic orogenic processes, with the separation of several Neoproterozoic arc terranes from the continental margin of northern Gondwana. Separation likely occurred along a former Neoproterozoic suture in response to slab pull in the outboard Iapetus Ocean. The Rheic Ocean broadened at the expense of Iapetus and attained its greatest width (>4000 km) in the Silurian, by which time Baltica had sutured to Laurentia and the Neoproterozoic arc terranes had accreted to Laurussia, closing Iapetus in the process. Closure of the Rheic Ocean began in the Devonian and was largely complete by the Mississippian as Gondwana and Laurussia sutured to build Pangea. In this process, North Africa collided with southern Europe to create the Variscan orogen in the Devonian-Carboniferous, and West Africa and South America sutured to North America to form the Alleghanian and Ouachita orogens, respectively, during the Permo-Carboniferous.

The Rheic Ocean has long been recognized as the major Paleozoic ocean in southern Europe, where its history dominates the basement geology. In North America, however, the Rheic has historically received less attention than Iapetus because its suture is not exposed. Yet, it was the Rheic Ocean

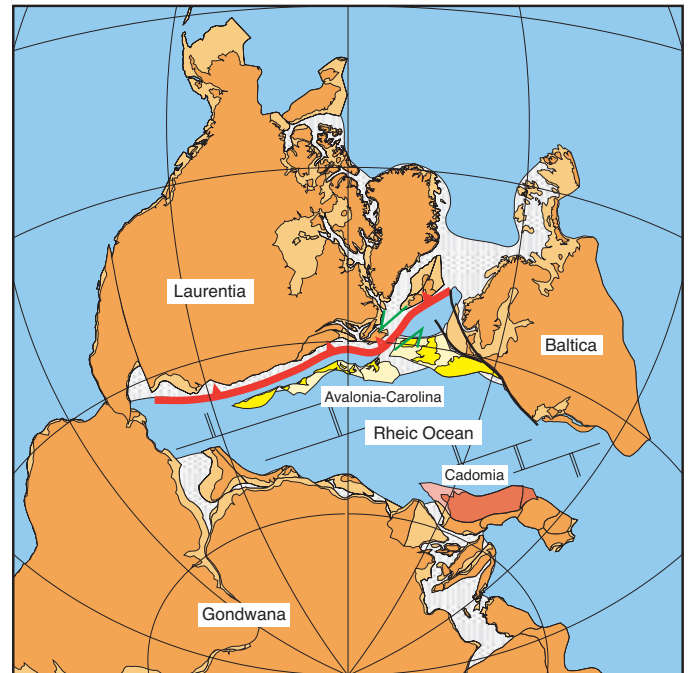


Figure 1. Early Silurian reconstruction of the Rheic Ocean immediately prior to the closure of Iapetus by way of subduction beneath Laurentia (toothed red line). Stippled areas denote inferred regions of thinned and/or anomalous thickness of continental and arc crust (simplified after Pickering and Smith, 1995, with Cadomia placed adjacent to Gondwana). Rheic ridge-transform system is purely schematic. Heavy black lines trace Tornquist suture zone.

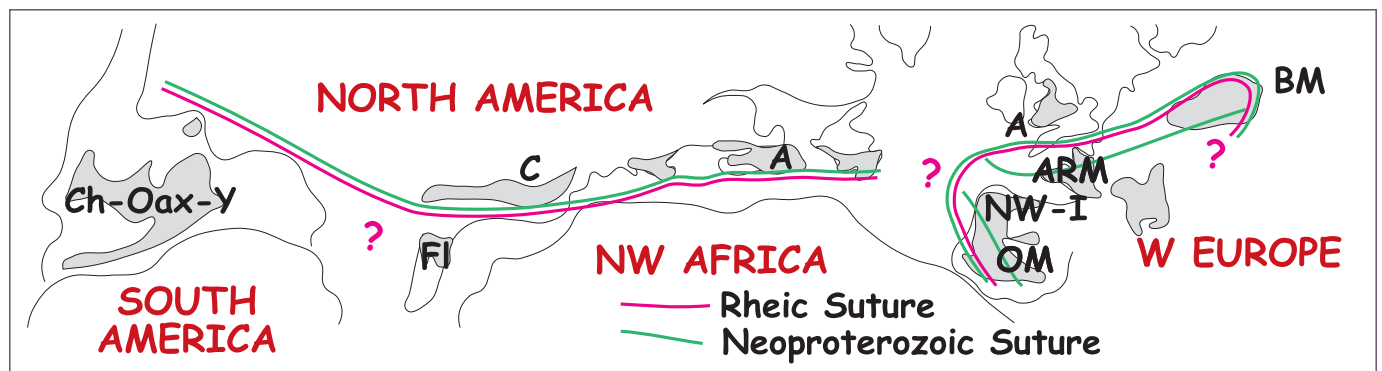


Figure 2. Location of Rheic suture on early Mesozoic reconstruction of the North Atlantic and its close correspondence with sutures associated with the accretion of arc terranes to the northern Gondwanan margin in the late Neoproterozoic (from Murphy et al., 2006). A—Avalonia; ARM—Armorica; BM—Bohemian Massif; C—Carolina; Ch—Chortis; FI—Florida; NW-I—northwestern Iberia; Oax—Oaxaquia; OM—Ossa Morena; Y—Yucatán; question marks—areas where continuity of suture uncertain.

of Laurussia (Laurentia-Baltica-Avalonia) from Gondwana (Fig. 1). Subsequent closure of the Rheic Ocean produced the Ouachita-Alleghanian-Variscan orogeny and assembled the supercontinent of Pangea.

The Rheic Ocean's importance has long been recognized in Europe, where its suture is well constrained and separate from that of the Iapetus Ocean to the north. Hence, in Europe, the Caledonide orogen, created by the closure of Iapetus, is a geographically distinct orogenic belt from the Variscan orogen, created by the closure of the Rheic Ocean. In North America, however, the two sutures follow a similar path, and the importance of the Rheic Ocean is often overlooked. Instead, the history of the Appalachian-Ouachita orogen is traditionally described in terms of the evolution of Iapetus, the opening of which is recorded in the late Neoproterozoic–Early Cambrian rifted margin of eastern and southern Laurentia and whose closure is documented in the accretion of a variety of peri-Gondwanan arc terranes in the Silurian (e.g., van Staal et al., 1998). The Rheic Ocean, in contrast, opened in the Early Ordovician with the separation of these peri-Gondwanan arc terranes from the margin of northern Gondwana and closed with the collision of this margin with Laurussia during the Permo-Carboniferous assembly of Pangea (e.g., Murphy et al., 2006).

The lack of attention to the Rheic Ocean's role in the development of the Appalachian-Ouachita orogen is largely a function of geography. The orogen contains both the rifted margin and final suture of the Iapetus Ocean, and so preserves a complete record of its opening and closure. But it preserves no such margin of the Rheic Ocean, the suture of which lies buried beneath the sediments of the Coastal Plain outboard of the accreted peri-Gondwanan terranes or was removed with the opening of the Atlantic Ocean and the Gulf of Mexico. Nevertheless, the continent-continent collision that produced the Appalachian-Ouachita orogen in the late Paleozoic was the result of the closure, not of Iapetus, but of the younger Rheic Ocean, important vestiges of which may be preserved in Mexico.

This paper aims to correct this oversight by providing a review of the origin and evolution of the Rheic Ocean that demonstrates its significance to the geological history of both Europe and North America. The time scale used is that of Gradstein et al. (2004).

## EVOLUTION OF THE RHEIC OCEAN

The initial rifting of the Rheic Ocean forms a continuum with the Neoproterozoic–Early Cambrian accretionary orogenic processes that preceded it. Rifting took place along the northern (African–South American) margin of Gondwana in the mid- to Late Cambrian, by which time Iapetus was already a wide ocean. Prior to this, in the late Neoproterozoic, the northern Gondwanan margin had witnessed a prolonged history of subduction and accretion followed in the Late Ediacaran–Early Cambrian by the diachronous cessation of arc magmatism and the development of a transform continental margin (e.g., Nance et al., 2008). This pre-rift history is analogous to that of the Pacific margin of North America in the Cenozoic, and the transition in tectonic regime along the Gondwanan margin has been similarly attributed to ridge-trench collision (e.g., Nance et al., 2002).

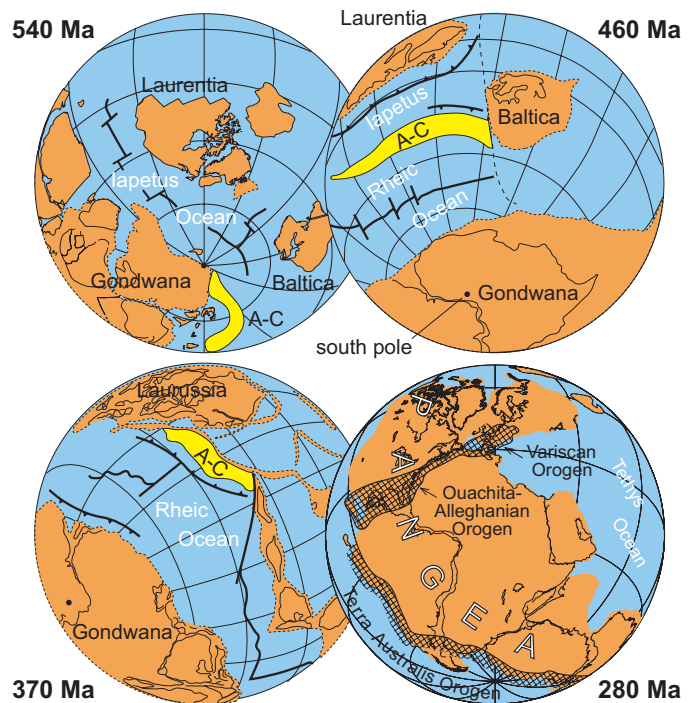


Figure 3. Paleozoic reconstructions modified from Murphy and Nance (2008). By 540 Ma, the Iapetus Ocean had formed between Laurentia and Gondwana. By 460 Ma, Avalonia-Carolina (A-C) had separated from Gondwana, creating the Rheic Ocean. By 370 Ma, Laurentia, Baltica, and Avalonia-Carolina had collided to form Laurussia, and the Rheic Ocean began to contract, closing by 280 Ma to form Pangea.

Following protracted rifting, the Rheic Ocean opened in the Early Ordovician with the separation of several Neoproterozoic arc terranes from the margin of northern Gondwana. The micro-continental terranes that separated (e.g., Avalonia and Carolina) were the same terranes that had accreted to this margin in the late Neoproterozoic, leading Murphy et al. (2006) to suggest that separation occurred along the line of a former Neoproterozoic suture (Fig. 2).

In Europe, separation of Avalonia by Arenig time is supported by paleomagnetic data (e.g., Cocks and Torsvik, 2002) and Sm/Nd isotopic studies of the sedimentary record (Thoroughgood, 1990), and is also recorded in the widespread deposition of the Armorican Quartzite. In Mexico, the onset of passive margin sedimentation occurred in the latest Cambrian (Landing et al., 2007), whereas backstripped subsidence curves in eastern Avalonia suggest that drifting may not have been achieved until the mid-Arenig to Llanvirn (Prigmore et al., 1997). It is therefore likely that the rifting and separation of terranes from northern Gondwana took place diachronously. Also during this time, the Early Ordovician Gondwanan fauna of Avalonia were gradually replaced by endemic forms (Fortey and Cocks, 2003).

Throughout the Ordovician, the Rheic Ocean widened at the expense of Iapetus as Avalonia-Carolina drifted northward toward Baltica and Laurentia (Fig. 3). The endemic fauna of Avalonia were progressively replaced by those of Baltic and Laurentian affinities in the Llandeilo-Ashgillian (Fortey and Cocks, 2003), suggesting increasing proximity to these continents and a widening gap with Gondwana by the mid-Ordovician (ca. 465 Ma). Similarly, paleomagnetic data indicate that

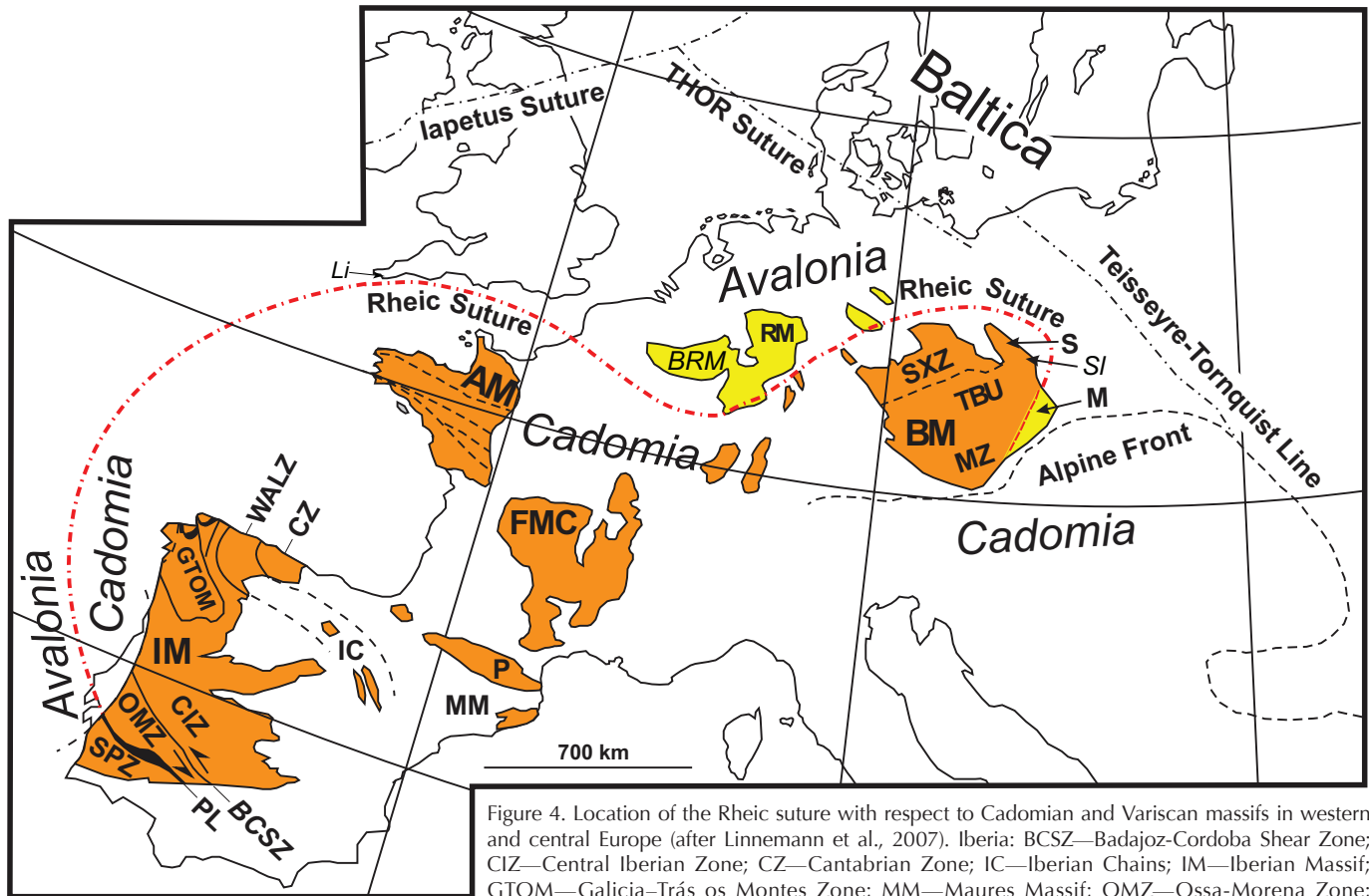


Figure 4. Location of the Rheic suture with respect to Cadomian and Variscan massifs in western and central Europe (after Linnemann et al., 2007). Iberia: BCSZ—Badajoz-Cordoba Shear Zone; CIZ—Central Iberian Zone; CZ—Cantabrian Zone; IC—Iberian Chains; IM—Iberian Massif; GTOM—Galicia-Trás os Montes Zone; MM—Maures Massif; OMZ—Ossa-Morena Zone; P—Pyrénées; PL—Pulo de Lobo oceanic unit; SPZ—South Portuguese Zone; WALZ—West

Asturian Leonese Zone. Western Europe: AM—Armorican Massif; FMC—French Massif Central; Li—Lizard Ophiolite. Central and Eastern Europe: BM—Bohemian Massif; BRM—Brabant Massif; M—Moravo-Silesian Zone; MZ—Moldanubian Zone; RM—Rhenish Massif; S—Sudetes; SI—Sleza ophiolite; SXZ—Saxo-Thuringian Zone; TBU—Teplá-Barrandian Unit. Areas in black—oceanic rocks of the Pulo de Lobo suture (Beja-Acebuches ophiolite) in southern Iberia and ophiolitic units of allochthonous complexes in northwestern Spain (Galicia). Rheic suture (dashed red line) separates Avalonia from Cadomia.

by 460 Ma Avalonia lay at 41°S (Hamilton and Murphy, 2004), some 1700–2000 km south of Laurentia (at ~20°S; Mac Niocaill and Smethurst, 1994) and ~2100 km north of Gondwana (at ~60°S; Cocks and Torsvik, 2002). This requires Avalonia to have drifted northward at the relatively rapid rate of 8–10 cm/yr. This is well in excess of modern ridge-push spreading rates (1–2 cm/yr), which suggests that the opening of the Rheic Ocean was likely driven by slab pull within the closing Iapetus Ocean to the north. Even faster rates may have been attained by Carolina, which was likely attached to, but ~2000 km north of, Avalonia and minimally separated from Laurentia latitudinally by ca. 455 Ma (e.g., Hibbard et al., 2002). European Cadomia (Fig. 1), also part of the active Neoproterozoic margin of Gondwana, likely remained on the northern Gondwanan margin, forming the southern margin of the Rheic Ocean from Lower Ordovician until at least uppermost Devonian times. This is supported by paleomagnetic data and the southerly paleolatitude of Cadomia in the Late Ordovician, indicated by widespread evidence for glaciation, which is characteristic of Gondwana but absent in Avalonia (e.g., Linnemann et al., 2004).

The Rheic Ocean reached its greatest width (>4000 km) in the Silurian (Fig. 1), by which time Laurentia had collided with Baltica to the north and with Avalonia-Carolina to the south,

closing the Iapetus Ocean and creating the Appalachian-Caledonide orogen. Closure of the Rheic began in the Early Devonian and was facilitated by northward subduction beneath the southern margin of Baltica in the Variscan belt, where arc magmatism developed on the previously accreted Avalonian terranes (e.g., Kroner et al., 2007), and by southward subduction beneath the northwestern margin of Gondwana in the Appalachian-Ouachita belt, where Laurentia forms the lower plate (Hatcher, 1989; Viele and Thomas, 1989). Closure was accompanied ca. 395–370 Ma by the emplacement of ophiolites in southern Britain and northwestern and southern Iberia, and may have accelerated as a result of ridge-trench collision along the ocean's northern margin (Woodcock et al., 2007). Closure was essentially complete by the Mississippian as Gondwana and Laurussia collided, a process that continued into the Early Permian. The sequential collision of Gondwana's West African margin with southern Baltica and eastern Laurentia created the Variscan and Alleghanian orogens, respectively, and reactivated the Mauritanides of West Africa (e.g., Piqué and Skehan, 1992), whereas Gondwana's Amazonian margin collided with southern Laurentia to produce the Ouachita orogen. The resulting Ouachita-Alleghanian-Variscan belt was the largest collisional orogen of the Paleozoic and sutured Gondwana and Laurussia to form Pangea (Fig. 3).

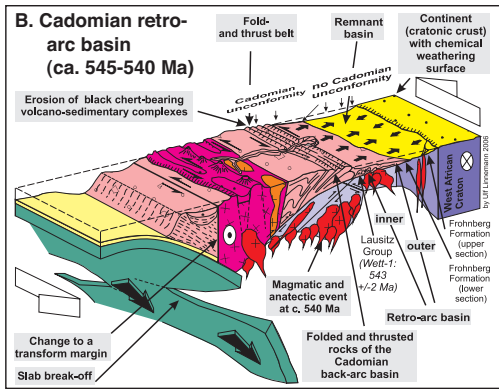
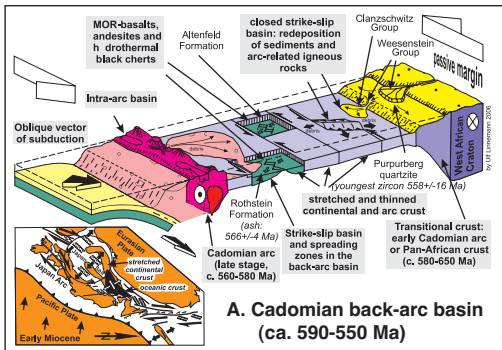


Figure 5. Model for the plate-tectonic transition from Cadomian arc to Rheic Ocean in central Europe based on data derived from the Saxo-Thuringian zone of the Bohemian Massif (from Linemann et al., 2007). (A) Cadomian backarc basin development ca. 590–545 Ma. (B) Cadomian retro-arc foreland basin development ca. 545–540 Ma. (C) Early to Middle Cambrian asymmetric rifting ca. 530–500 Ma. (D) Upper Cambrian oceanic ridge incision ca. 500–490 Ma (MOR—mid-ocean ridge). (E) Early Ordovician Rheic rift-drift transition ca. 490–480 Ma. Inset in (A) shows analogous setting illustrated by the opening of the Japan Sea in the Early Miocene (after Jolivet et al., 1992). Insets in (C–E) show analogous settings (circled) illustrated by the Miocene-Pliocene evolution of the Pacific margin of North America (from Nance et al., 2002; modified after Atwater, 1970; Dickinson, 1981).

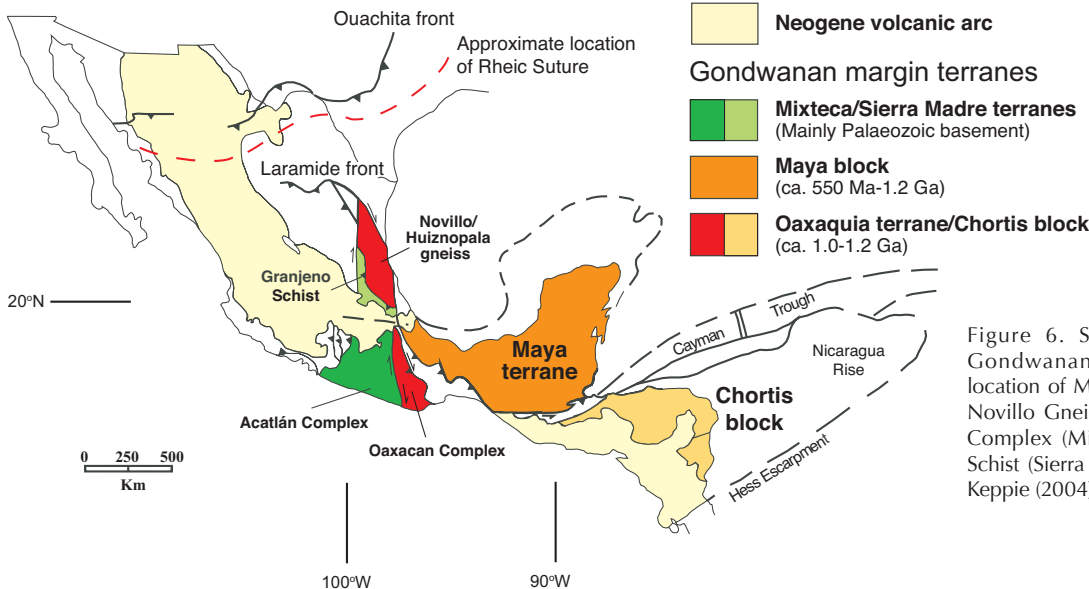
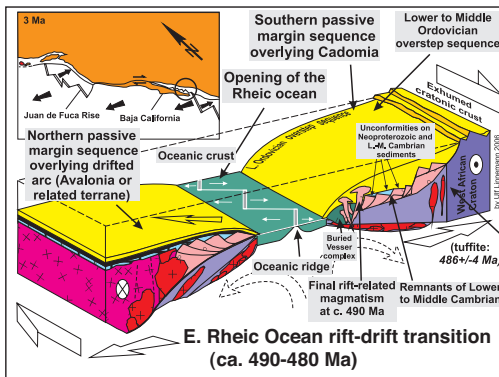
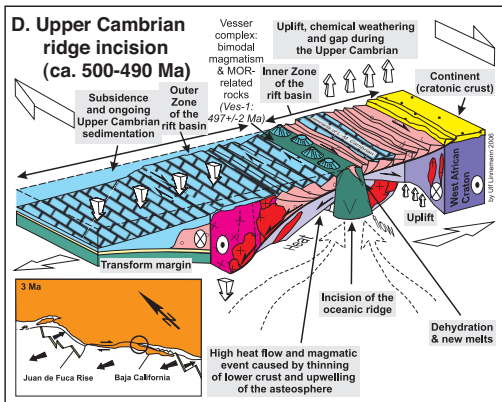
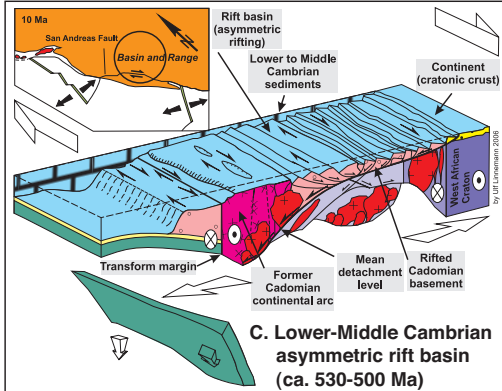


Figure 6. Simplified tectonic map of Gondwanan Middle America showing location of Mexico's Oaxacan Complex and Novillo Gneiss (Oaxaquia terrane), Acatlán Complex (Mixteca terrane), and Granjeno Schist (Sierra Madre terrane). Modified after Keppie (2004).

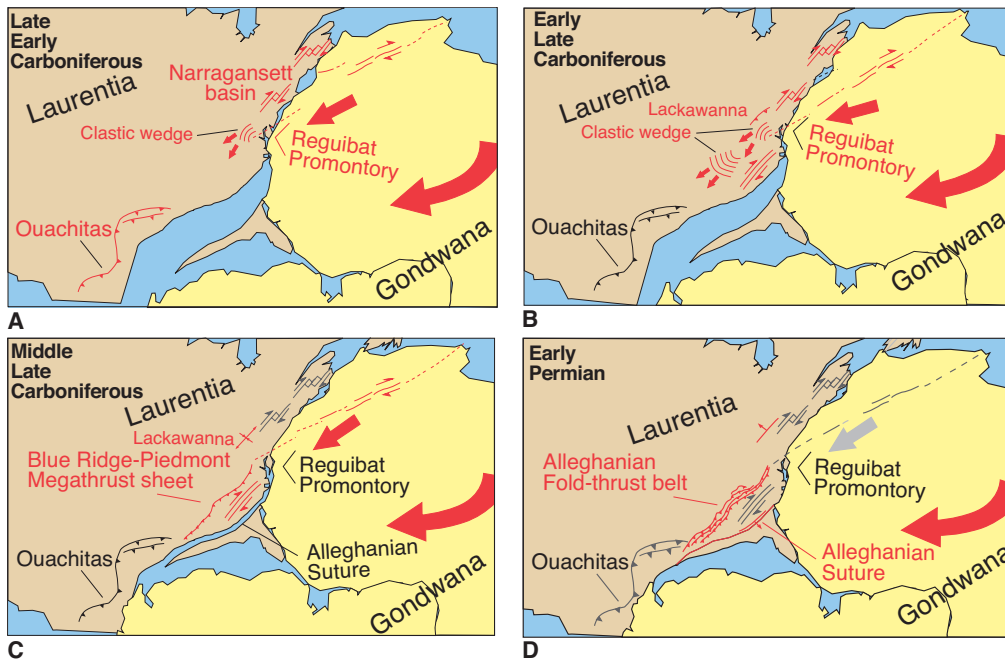


Figure 7. Oblique rotational collision between Laurentia and Gondwana according to Hatcher (2002). Symbols in red identify features active during time interval represented. (A) Initial contact between Laurentia and Gondwana during the late Mississippian. (B) Southward motion and clockwise rotation of Gondwana during the early Pennsylvanian. (C) Continued rotation and southward movement of Gondwana in the late Pennsylvanian. (D) Head-on Laurentia-Gondwana collision in the Early Permian.

### THE RHEIC OCEAN IN CENTRAL EUROPE

The formation of the Rheic Ocean in Europe is closely linked to the termination of the late Neoproterozoic Cadomian orogeny (ca. 700–540 Ma), and its closure caused the Variscan orogeny. This closure, ca. 370–330 Ma, produced a suture (Fig. 4) that runs westward from the Mid-German Crystalline zone in Germany and the Lizard ophiolite in southern Britain to the Pulo do Lobo unit of southern Iberia. To the east, in the Bohemian Massif, the Rheic suture is documented by the Sleza ophiolite (e.g., Floyd et al., 2002) in the Sudetes and may extend to the Moravo-Silesian zone on the massif's eastern margin (considered part of Avalonia; Finger et al., 2000) and on into Eastern Europe (Bulgaria, Romania, Turkey; e.g., Winchester et al., 2002).

In central and western Europe, the suture separates Cadomia and its Paleozoic passive margin from the southern margin of Laurussia as represented by the eastern part of Avalonia and its overlying Paleozoic strata. Important vestiges of the Rheic Ocean exist (1) in the Cornubian basins and Lizard ophiolite of southern Britain (e.g., Nutman et al., 2001); (2) in the development ca. 500 Ma of a passive margin sequence and emplacement ca. 340 Ma of ophiolitic allochthons in northwestern Iberia (e.g., Sánchez-Martínez et al., 2007); (3) in the well-documented rift succession of the Ossa-Morena Zone (e.g., Sánchez-García et al., 2003) as well as the Pulo do Lobo accretionary prism and Beja-Acebuches ophiolite in southern Iberia (Quesada et al., 1994); and (4) in the evidence of an Early Ordovician breakup unconformity and widespread sub-

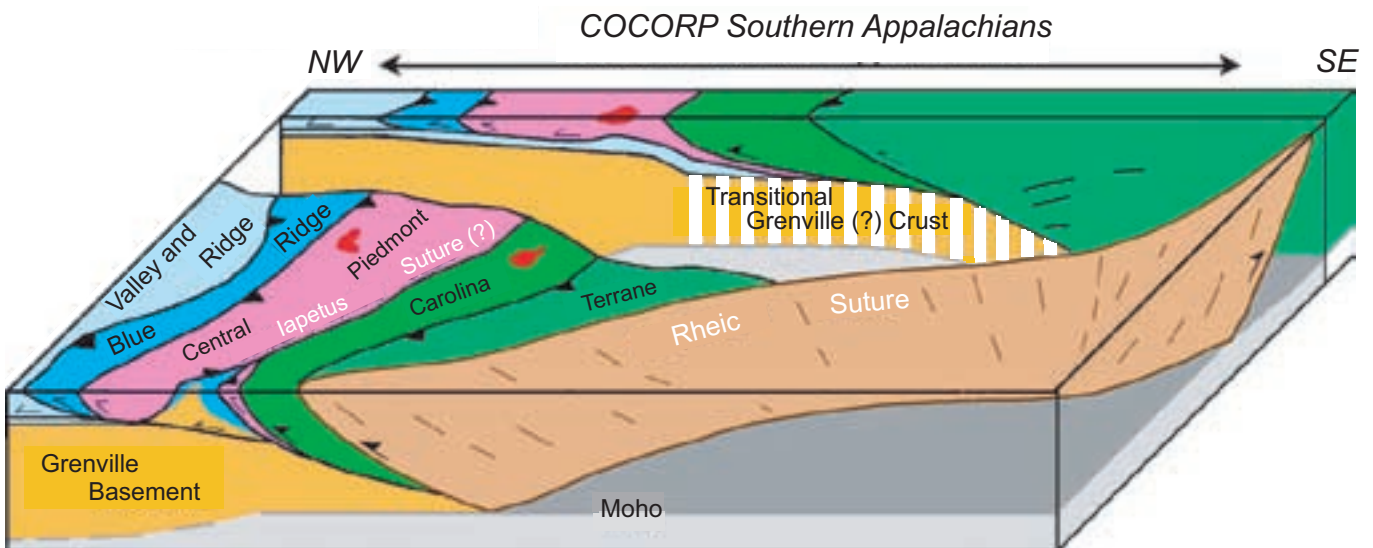


Figure 8. Schematic block diagram of the crustal structure of the southeastern Appalachians based on reprocessed data from the Consortium for Continental Reflection Profiling (COCORP) reflection survey (modified from Cook and Vasudevan, 2006).



sidence indicated by the distribution of the Armorican Quartzite across Iberia and northwestern France. We focus here, however, on the northern Bohemian Massif, where the record of the evolution of the Rheic Ocean is most complete. In this region (Fig. 4), the northern (Avalonian) margin of the Rheic Ocean is represented by the Brabant and Rhenish massifs (Rhenohercynian zone), the suture by the Mid-German Crystalline zone, and the southern (Gondwanan) margin by the northern Bohemian Massif (Saxo-Thuringian and Moldanubian zones).

### **Rifting and Opening: Aftermath of the Cadomian Orogeny**

In western and central Europe, there is no sharp break between the Cadomian orogeny of the late Neoproterozoic–Early Cambrian and the Cambro-Ordovician rifting that led to the opening of the Rheic Ocean. Hence, the active margin processes that characterize the Cadomian orogen form an important precursor to the opening of the Rheic. The stages involved for the Saxo-Thuringian zone are summarized in Figure 5 (Linnemann et al., 2007).

The oldest (ca. 570–565 Ma) rocks in the Saxo-Thuringian zone are thought to record late Neoproterozoic backarc basin development on the active West African margin of Gondwana in a manner analogous to the present-day Sea of Japan (Fig. 5A). Subsequent inversion of this basin in the interval ca. 545–540 Ma is attributed to collision of the arc with the West African craton and the development of a short-lived backarc foreland basin (Fig. 5B). Granitoids emplaced ca. 540 Ma were likely derived from melting of the basin fill and are thought to record a pulse of high heat-flow that is attributed to slab break-off as a result of ridge-trench collision.

Following this event, the margin switched from active to transform, leading to the development of asymmetric rifts in the Lower and Middle Cambrian similar to those of the present-day Basin and Range Province (Fig. 5C). Subsequent ridge incision like that currently taking place in the Gulf of California is thought to be recorded in the oceanic rocks of the Upper Cambrian Vesser Complex (Fig. 5D).

Lower Ordovician deposits throughout the Cadomian part of central and western Europe are characterized by the Armorican Quartzite and its equivalents, which, in the Saxo-Thuringian zone, are ~3000 m thick. These deposits overstep Lower to Middle Cambrian strata or lie directly on Cadomian basement (Fig. 5E), indicating significant thermal subsidence. Their deposition follows the final rift-related magmatism ca. 485 Ma and is taken to record the opening of the Rheic Ocean and the separation of Avalonia from the Gondwanan margin.

From the mid-Upper Ordovician to mid-Devonian, the Saxo-Thuringian zone is characterized by relatively quiescent shelf sedimentation, consistent with its position on the southern passive margin of the Rheic Ocean. In places, sedimentation continued into the Lower Carboniferous, but by the Upper Devonian, Rheic Ocean closure had incorporated portions of the shelf into the developing Variscan orogen.

### **Closure and Collision**

In Europe, the Rheic Ocean continued to expand until (1) Avalonia collided with Baltica ca. 450 Ma with the closure of the Tornquist Sea along the Teisseyre-Tornquist Line (Fig. 4); and (2) Baltica-Avalonia collided with Laurentia to form Laurussia

with the closure of the Iapetus Ocean. Closure of Iapetus was complete by the latest Silurian (e.g., Pickering, 2008), following which Avalonia became part of the Old Red Continent and was blanketed by Lower Devonian redbeds.

The onset of Rheic Ocean closure may be recorded in the Mid-German Crystalline zone by a Late Silurian to Lower Devonian (ca. 418–400 Ma) magmatic event that has been attributed to north-directed subduction beneath Laurussia following the closure of Iapetus (e.g., Kroner et al., 2007). Final closure of the Rheic Ocean in Europe is marked by the Variscan orogeny, which, in the Saxo-Thuringian zone and elsewhere, juxtaposed widespread Late Devonian to Early Carboniferous high-pressure metamorphic units (allochthonous domains) against low-grade Cadomian and Paleozoic successions (autochthonous domains). Following destruction of the Rheic Ocean floor, oblique subduction of thinned Gondwanan continental crust began in the Early Devonian and persisted until the Early Carboniferous with early exhumation of Gondwanan high-pressure rocks ca. 370 Ma. These rocks were locally subducted to depths at which metamorphic diamond is stable (~120 km). Southeast-directed exhumation was initially accommodated in the subduction channel, after which (ca. 340–330 Ma) regional dextral transpression, rapid exhumation of the rocks of the allochthonous domain, and filling and folding of flysch basins occurred. Related widespread Variscan plutonism occurred in the Bohemian Massif ca. 335–320 Ma. Consistent with this evolution, the Mid-German Crystalline zone, which defines the Rheic suture, records a Late Devonian–Early Carboniferous history of oblique subduction, collision, exhumation, and strike-slip tectonics.

### **THE RHEIC OCEAN IN NORTH AMERICA**

Although the Rheic suture is not exposed in North America, closure of the Rheic Ocean in the late Paleozoic dictated the sedimentary and deformational history of the entire Ouachita-Appalachian orogen. Furthermore, important vestiges of the ocean's southern (Gondwanan) rifted continental margin and a possible record of its Late Devonian–Mississippian subduction are preserved in the Mixteca, Sierra Madre, and Oaxaquia terranes of southern and eastern Mexico (e.g., Nance et al., 2007).

### **Rifting and Opening**

Within the Appalachians, evidence of the opening of the Rheic Ocean occurs only in those peri-Gondwanan terranes that defined the ocean's northern margin and that were accreted to Laurentia with the closure of Iapetus. In Avalonia, for example, minor bimodal rift volcanism, predominantly of Middle to Late Cambrian age but locally spanning the entire Cambrian (e.g., Greenough and Papezik, 1986), may record initial rifting.

Faunal data suggest that rifting was a protracted process. Distinct faunal provinciality in the Early Cambrian suggests that Avalonia and Gondwana were separate (e.g., Landing, 1996), although the seaway between the two was narrow because the separation is not detectable paleomagnetically (e.g., Van der Voo, 1988). By the Middle Cambrian, the faunal barrier had broken down and, in the Early Ordovician, the fauna of Avalonia are of Gondwanan affinity. Faunal provinciality and paleomagnetic data following the Early Ordovician document the

increasing separation of Avalonia from Gondwana (e.g., Cocks and Torsvik, 2002).

In Mexico, vestiges of the Gondwanan continental margin of the Rheic Ocean are preserved in the Oaxaquia terrane, and voluminous bimodal magmatism that is interpreted to record rifting along this margin is present in the adjacent Mixteca terrane (Fig. 6). The Oaxaquia terrane, the largest exposed portions of which are the Oaxacan Complex and Novillo Gneiss, exposes Mesoproterozoic (ca. 1.0–1.2 Ga) basement (e.g., Keppie, 2004) unconformably overlain by latest Cambrian–Early Ordovician (Tremadocian) and mid-Silurian (early to mid-Wenlock) continental margin siliciclastics containing fauna of Gondwanan affinity (e.g., Boucot et al., 1997; Landing et al., 2007).

To the west, the Mixteca and Sierra Madre terranes are interpreted to contain vestiges of the Rheic Ocean juxtaposed against the Oaxaquia terrane along major north-south dextral faults of Early Permian age (Nance et al., 2007, and references therein). These vestiges form a major component of the Acatlán Complex, which constitutes the basement of the Mixteca terrane, as well as the Granjeno Schist of the Sierra Madre terrane to the north. In the Acatlán Complex, megacrystic granitoids and amphibolites of Ordovician age (ca. 440–480 Ma) intrude siliciclastic metasedimentary rocks (Piaxtla Suite) with detrital zircon signatures that closely match those of the early Paleozoic platform overlying the Oaxacan Complex (Gillis et al., 2005). The association is interpreted as a part of a protracted rift–passive margin sequence (e.g., Miller et al., 2007) analogous to the present-day Gulf of California, in which rifting continued well beyond terrane separation. Predominantly low-grade siliciclastic rocks of pre-Carboniferous age are thought to represent either continental rise deposits laid down within the Rheic Ocean or trench deposits associated with its subsequent closure.

### Closure and Collision

Subduction of the Rheic Ocean in the Late Devonian–Mississippian is thought to be documented in the Piaxtla Suite of the Acatlán Complex by eclogites and decompression migmatites with ages of ca. 345–350 Ma (Middleton et al., 2007) and by high-pressure rocks (including blueschists) with ages spanning the interval 320–345 Ma (Vega-Granillo et al., 2007). Associated arc rocks are not preserved, nor are they present in the Ouachita orogen, where the arc is most likely to have accreted and where pyroclastic detritus and tuffs indicating the approach of an arc occur in rocks of Middle Mississippian age (e.g., Morris, 1989). Boulders of Devonian igneous and metamorphic rocks in strata of Pennsylvanian age (Dennison et al., 1977) may also attest to subduction in the outboard Rheic Ocean. The absence of an arc in Mexico has led Keppie et al. (2008) to suggest that, in this segment of the Rheic, the arc may have been removed by subduction erosion beneath the Oaxacan (Gondwanan) margin. Evidence of arc-related igneous rocks of Devonian–Mississippian age is likewise absent in the Appalachian orogen (e.g., Hermes and Murray, 1988), indicating that Laurentia, in contrast to Baltica, formed the lower plate during Rheic Ocean closure.

Closure of the Rheic Ocean resulted in the formation of the Ouachita belt and gave rise to the climactic phase in Appalachian orogenesis with the development of the Alleghanian

orogen. Ocean closure was also responsible for the burial of the Laurentian platform, which was carbonate-dominated in the Mississippian, by thick Pennsylvanian clastic wedges that were shed westward (in the Appalachians) and northward (in the Ouachitas) into developing foreland basins from the rising orogenic front (e.g., Hatcher, 1989; Viele and Thomas, 1989). The onset of this clastic deposition took place in the Middle Mississippian, which, in the southern Appalachians, broadly coincides with the earliest ductile thrusting in the orogenic interior (ca. 335 Ma; Wortman et al., 1998).

Alleghanian deformation brought about by the collision of Gondwana and Laurentia likely involved oblique, rotational and orthogonal components and spanned the Pennsylvanian into the Early Permian (Fig. 7). In the northern Appalachians, Alleghanian orogenesis occurred as the result of oblique convergence between Laurentia and Gondwana and is dominated by dextral strike-slip tectonics on major northeast- and east-trending faults. In Canada, deformation is largely of Late Pennsylvanian age, and deposition was mainly confined to small wrench-related basins (e.g., Marillier, 1993). In New England, deformation was accompanied by Barrovian-style metamorphism that locally reached the sillimanite zone and has yielded cooling ages that span the Permian (e.g., Wintsch et al., 2003). Associated anatectic magmatism took place in the Late Carboniferous (ca. 325–305 Ma) and, more locally, in the Early Permian (ca. 275 Ma), presumably as the result of crustal thickening.

In contrast, in the Ouachitas and the central and southern Appalachians, the deformational architecture takes the form of crustal-scale décollement structures that verge north and west, respectively. Seismic profiling across the southern Appalachians (e.g., Cook and Vasudevan, 2006) shows these structures to be orogen-wide, with the Laurentian platform on the lower plate extending almost 100 km beneath the crystalline thrust sheets of the orogenic interior (Fig. 8). In this way, the foreland fold-thrust belts that are the hallmark of Ouachita-Alleghanian orogenesis and that first developed within the exposed Laurentian platform in the Early Pennsylvanian (e.g., Hatcher, 1989; Viele and Thomas, 1989) represent only the supracrustal toes of low-angle structures that originated in the mid-crust and rose in stair-step fashion to progressively higher crustal levels.

Post-Mississippian deformation in the orogenic hinterland of the southern Appalachians is accompanied by dextral strike-slip tectonics on northeast-trending ductile shear zones, and, as in New England, is associated with significant metamorphism and anatectic magmatism (e.g., Horton et al., 1987). Metamorphism locally reached the kyanite zone and records hornblende cooling ages of 320–295 Ma (Dallmeyer et al., 1986). Widespread granitoid magmatism of latest Mississippian–Pennsylvanian age (ca. 321–304 Ma; e.g., Samson, 2001) either accompanied or followed the metamorphism and, again, is probably the result of tectonic thickening of the crust in response to transpressive convergence between Laurentia and Gondwana (e.g., Hatcher, 2002).

In contrast, the Ouachita orogen is distinctive in that metamorphism is essentially absent and there is no associated magmatic activity. Where present, metamorphism is mostly of subgreenschist facies of poorly constrained Pennsylvanian to

mid-Permian age (e.g., Viele and Thomas, 1989). Hence, the exposed portion of the orogen presumably lay well to the north of the Rheic suture. Following cessation of orogenic activity, this suture likely separated Laurentia from the Maya terrane (Fig. 6), which, prior to the opening of the Gulf of Mexico, is thought to have been contiguous with the Florida basement (e.g., Dickinson and Lawton, 2001).

## CONCLUSIONS

As the ocean whose closure was responsible for the creation of the >10,000 km Ouachita-Alleghanian-Variscan orogen and the assembly of the supercontinent of Pangea, the Rheic Ocean is arguably the most important ocean of the Paleozoic. Following the onset of subduction within the older Iapetus Ocean, the Rheic opened in the Early Ordovician as the result of the separation of Avalonia-Carolina from the northern margin of Gondwana along the line of a Neoproterozoic suture, likely in response to Iapetus slab pull. Records of this rifting and subsequent passive-margin development are preserved on the Gondwanan margin in the Oaxaquia and Mixteca terranes of southern Mexico, the Ossa-Morena zone of southern Spain, and the northern Bohemian Massif of central Europe. They are also preserved in Avalonia, the faunal and paleomagnetic records of which document the terrane's rapid northward drift toward Laurentia during the mid- to Late Ordovician.

The Rheic Ocean reached its maximum width (>4000 km) in the Silurian, following the accretion of Avalonia-Carolina to Laurentia and Baltica with the closure of Iapetus and the Tornquist Sea. Rheic Ocean closure began in the Early Devonian with subduction beneath both Baltica and northwestern Gondwana, and is recorded in the mid- to Late Devonian by ophiolite emplacement in southern Britain and northwestern and southern Iberia, and in the Late Devonian–Mississippian by eclogite facies metamorphism in Mexico and Europe.

By the Mississippian, closure was essentially complete, but it continued into the Early Permian as Gondwana's irregular West African margin collided with, and then moved westward and southward relative to, southern Baltica and eastern Laurentia, while its Amazonian margin converged with southern Laurentia. As a result, all three paleocontinents were sutured to form Pangea by the largest collisional orogenic belt of the Paleozoic. Closure of the Rheic Ocean played an unparalleled role in the sedimentary, structural, and tectonothermal record of the late Paleozoic from Central America to the Middle East and, with its completion, brought the Paleozoic era to an end.

## ACKNOWLEDGMENTS

This paper is an outcome of International Geoscience Programme (IGCP) Project 497 awarded to Linnemann and Nance by the International Union of Geological Sciences and UNESCO. Nance additionally acknowledges U.S. National Science Foundation grant EAR-0308105 and an Ohio University Baker Award, and is indebted to Ibrahim Çemen for informative discussions on the Ouachitas. The authors are indebted to the remaining board members of IGCP Project 497—Erdin Bozkurt, Rob Stachan, Francisco Pereira, Maarten de Wit, Petr Kraft, Kerstin Drost, and Mandy Hofmann—and extend their thanks to all those who organized meetings, field trips, and special volumes in connection with this project. We also thank Margarete Patzak (UNESCO)

and Sören Dürr (Deutsche Forschungsgemeinschaft [DFG—German Research Foundation]) for their help and support. Constructive comments by Peter Cawood and Gabi Gutiérrez-Alonso significantly improved the original manuscript.

## REFERENCES CITED

- Atwater, T., 1970, Implications of plate tectonics for the Cenozoic tectonic evolution of western North America: *Geological Society of America Bulletin*, v. 81, p. 3513–3536, doi: 10.1130/0016-7606(1970)81[3513:IOPTFT]2.0.CO;2.
- Boucot, A.J., Blodgett, R.B., and Stewart, J.H., 1997, European Province Late Silurian brachiopods from the Ciudad Victoria area, Tamaulipas, northeastern Mexico, in Klapper, G., Murphy, M.A., and Talent, J.A., eds., *Paleozoic Sequence Stratigraphy, Biostratigraphy, and Biogeography: Studies in Honor of J. Grenville ("Jess") Johnson: Geological Society of America Special Paper 321*, p. 273–293.
- Cocks, L.R.M., and Torsvik, T.H., 2002, Earth geography from 500 to 400 million years ago: A faunal and palaeomagnetic review: *Journal of the Geological Society*, v. 159, p. 631–644, doi: 10.1144/0016-764901-118.
- Cook, F.A., and Vasudevan, K., 2006, Reprocessing and enhanced interpretation of the initial COCORP Southern Appalachians traverse: *Tectonophysics*, v. 420, p. 161–174, doi: 10.1016/j.tecto.2006.01.022.
- Dallmeyer, R.D., Wright, J.E., Secor, D.T., Jr., and Snoke, A.W., 1986, Character of the Alleghanian orogeny in the southern Appalachians: Part II. Geochronological constraints on the tectonothermal evolution of the eastern Piedmont in South Carolina: *Geological Society of America Bulletin*, v. 97, p. 1329–1344, doi: 10.1130/0016-7606(1986)97<1329:COTAOI>2.0.CO;2.
- Dennison, R.E., Burke, W.H., Otto, J.B., and Heatherington, E.A., 1977, Age of igneous and metamorphic activity affecting the Ouachita folded belt, in Stone, C.G., ed., *Symposium on the geology of the Ouachita Mountains, Volume 1: Arkansas Geological Commission*, p. 25–40.
- Dickinson, W.R., 1981, Plate tectonics and the continental margin of California, in Ernst, W.G., ed., *The Geotectonic Development of California: Englewood Cliffs, New Jersey, Prentice-Hall*, p. 1–28.
- Dickinson, W.R., and Lawton, T.F., 2001, Carboniferous to Cretaceous assembly and fragmentation of Mexico: *Geological Society of America Bulletin*, v. 113, p. 1142–1160, doi: 10.1130/0016-7606(2001)113<1142:CTCAAF>2.0.CO;2.
- Finger, F., Hanzl, P., Pin, C., von Quadt, A., and Steyrer, H.P., 2000, The Brunovistulian: Avalonian Precambrian sequence at the eastern Bohemian Massif: Speculations on palinspastic reconstruction, in Franke, W., Haak, V., Oncken, O., and Tanner, D., eds., *Orogenic Processes: Quantification and Modelling in the Variscan Belt: Geological Society [London] Special Publication 179*, p. 103–113.
- Floyd, P.A., Kryza, R., Crowley, Q.G., Winchester, J.A., and Wahed, A., 2002, Sleza Ophiolite: Geochemical features and relationship to Lower Palaeozoic rift magmatism in the Bohemian Massif, in Winchester, J.A., Pharaoh, T.C., and Verniers, J., eds., *Palaeozoic Amalgamation of Central Europe: Geological Society [London] Special Publication 201*, p. 197–215.
- Fortey, R.A., and Cocks, L.R.M., 2003, Palaeontological evidence bearing on global Ordovician–Silurian continental reconstructions: *Earth-Science Reviews*, v. 61, p. 245–307, doi: 10.1016/S0012-8252(02)00115-0.
- Gillis, R.J., Gehrels, G.E., Ruiz, J., and Flores de Dios González, L.A., 2005, Detrital zircon provenance of Cambrian–Ordovician and Carboniferous strata of the Oaxaca terrane, southern Mexico: *Sedimentary Geology*, v. 182, p. 87–100, doi: 10.1016/j.sedgeo.2005.07.013.
- Gradstein, F.M., Ogg, J.G., Smith, A.G., Bleeker, W., and Lourens, L.J., 2004, A new Geologic Time Scale, with special reference to Precambrian and Neogene: *Episodes*, v. 27, p. 83–100.
- Greenough, J.G., and Papezik, V.S., 1986, Acado-Baltic volcanism in eastern North America and Western Europe: Implications for Cambrian tectonism: *Maritime Sediments and Atlantic Geology*, v. 22, p. 240–251.
- Hamilton, M.A., and Murphy, J.B., 2004, Tectonic significance of a Llanvirn age for the Dunn Point volcanic rocks, Avalon terrane, Nova Scotia, Canada: Implications for the evolution of the Iapetus and Rheic Oceans: *Tectonophysics*, v. 379, p. 199–209, doi: 10.1016/j.tecto.2003.11.006.
- Hatcher, R.D., Jr., 1989, Tectonic synthesis of the U.S. Appalachians, in Hatcher, R.D., Jr., Thomas, W.A., and Viele, G.W., eds., *The Appalachian–Ouachita Orogen in the United States: Boulder, Colorado, The Geological Society of America, The Geology of North America*, v. F-2, p. 511–535.
- Hatcher, R.D., Jr., 2002, Alleghanian (Appalachian) orogeny, a product of zipper tectonics: Rotational transpressive continent–continent collision and closing of ancient oceans along irregular margins, in Martínez Catalán, J.R., Hatcher, R.D., Jr., Arenas, R., and Díaz García, F., eds., *Variscan–Appalachian dynamics: The building of the late Paleozoic basement: Geological Society of America Special Paper 364*, p. 199–208.
- Hermes, O.D., and Murray, D.O., 1988, Middle Devonian to Permian plutonism and volcanism in the N American Appalachians, in Harris, A.L., and Fettes, D.J., eds., *The Caledonian–Appalachian Orogen: Geological Society [London] Special Publication 38*, p. 559–571.
- Hibbard, J.P., Stoddard, E.F., Secor, D.T., and Dennis, A.J., 2002, The Carolina Zone: Overview of Neoproterozoic to Early Paleozoic peri-Gondwanan terranes along the eastern flank of the southern Appalachians: *Earth-Science Reviews*, v. 57, p. 299–339, doi: 10.1016/S0012-8252(01)00079-4.

- Horton, J.W., Sutter, J.F., Stern, T.W., and Milton, D.J., 1987, Alleghanian deformation, metamorphism, and granite emplacement in the central Piedmont of the Southern Appalachians: *American Journal of Science*, v. 287, p. 635–660.
- Jolivet, L.M., Fournier, P., Huchnon, V.S., Rozhdvestvenskiy, K.F.S., and Ostorbin, L.S., 1992, Cenozoic intracontinental dextral motion in the Okhotsk-Japan Sea region: *Tectonics*, v. 11, p. 968–977, doi: 10.1029/92TC00337.
- Keppie, J.D., 2004, Mexican terranes revisited: A 1.3 Ga odyssey: *International Geology Review*, v. 46, p. 765–794, doi: 10.2747/0020-6814.46.9.765.
- Keppie, J.D., Dostal, J., Murphy, J.B., and Nance, R.D., 2008, Synthesis and tectonic interpretation of the westernmost Paleozoic Variscan orogen in southern Mexico: From rifted Rheic margin to active Pacific margin: *Tectonophysics*, in press.
- Kroner, U., Hahn, T., Romer, R.L., and Linnemann, U., 2007, The Variscan orogeny in the Saxo-Thuringian zone-heterogeneous overprint of Cadomian/Paleozoic peri-Gondwana crust, in Linnemann, U., Nance, R.D., Kraft, P., and Zulauf, G., eds., *The evolution of the Rheic Ocean: From Avalonian-Cadomian active margin to Alleghanian-Variscan collision*: Geological Society of America Special Paper 423, p. 153–172.
- Landing, E., 1996, Avalon: Insular continent by the latest Precambrian, in Nance, R.D., and Thompson, M.D., eds., *Avalonian and Related Peri-Gondwanan Terranes of the Circum-North Atlantic*: Geological Society of America Special Paper 304, p. 29–63.
- Landing, E., Westrop, S.R., and Keppie, J.D., 2007, Terminal Cambrian and lowest Ordovician succession of Mexican West Gondwana: Biotas and sequence stratigraphy of the Tiñu Formation: *Geological Magazine*, v. 144, p. 909–936, doi: 10.1017/S0016756807003585.
- Linnemann, U., McNaughton, N.J., Romer, R.L., Gehmlich, M., Drost, K., and Tonk, C., 2004, West African provenance for Saxo-Thuringia (Bohemian Massif): Did Armorica ever leave pre-Pangean Gondwana?—U-Pb-SHRIMP zircon evidence and the Nd-isotopic record: *International Journal of Earth Sciences*, v. 93, p. 683–705, doi: 10.1007/s00531-004-0413-8.
- Linnemann, U., Gerdes, A., Drost, K., and Buschmann, B., 2007, The continuum between Cadomian orogenesis and opening of the Rheic Ocean: Constraints from LA-ICP-MS U-Pb zircon dating and analysis of plate-tectonic setting (Saxo-Thuringian zone, NE Bohemian massif, Germany), in Linnemann, U., Nance, R.D., Kraft, P., and Zulauf, G., eds., *The evolution of the Rheic Ocean: From Avalonian-Cadomian active margin to Alleghanian-Variscan collision*: Geological Society of America Special Paper 423, p. 61–96.
- Mac Niocaill, C., and Smethurst, M.A., 1994, Palaeozoic palaeogeography of Laurentia and its margins: a reassessment of palaeomagnetic data: *Geophysical Journal International*, v. 116, p. 715–725, doi: 10.1111/j.1365-246X.1994.tb03292.x.
- Marillier, F.J.Y., ed., 1993, *Tectonics of the Maritime Basin*: Atlantic Geology, v. 29, p. 179–270.
- Middleton, M., Keppie, J.D., Murphy, J.M., Miller, B.V., and Nance, R.D., 2007, *P-T* constraints on exhumation following subduction in the Rheic Ocean: Eclogitic Asis Lithodeme, Piaxtle Suite, Acatlán Complex, southern Mexico, in Linnemann, U., Nance, R.D., Kraft, P., and Zulauf, G., eds., *The evolution of the Rheic Ocean: From Avalonian-Cadomian active margin to Alleghanian-Variscan collision*: Geological Society of America Special Paper 423, p. 489–509.
- Miller, B.V., Dostal, J., Keppie, J.D., Nance, R.D., Ortega-Rivera, A., and Lee, J.K.W., 2007, Ordovician calc-alkaline granitoids in the Acatlán Complex, southern México: Geochemical and geochronologic data and implications for the tectonics of the Gondwanan margin of the Rheic Ocean, in Linnemann, U., Nance, R.D., Kraft, P., and Zulauf, G., eds., *The evolution of the Rheic Ocean: From Avalonian-Cadomian active margin to Alleghanian-Variscan collision*: Geological Society of America Special Paper 423, p. 465–475.
- Morris, R.C., 1989, Stratigraphy and sedimentary history of post-Arkansas Novaculite Carboniferous rocks of the Ouachita Mountains, in Hatcher, R.D., Jr., Thomas, W.A., and Viele, G.W., eds., *The Appalachian-Ouachita Orogen in the United States*: Boulder, Colorado, The Geological Society of America, *Geology of North America*, v. F-2, p. 591–602.
- Murphy, J.B., and Nance, R.D., 2008, The Pangea conundrum: *Geology*, v. 36, p. 703–706, doi: 10.1130/G24966A.1.
- Murphy, J.B., Gutierrez-Alonso, G., Nance, R.D., Fernandez-Suarez, J., Keppie, J.D., Quesada, C., Strachan, R.A., and Dostal, J., 2006, Origin of the Rheic Ocean: Rifting along a Neoproterozoic suture?: *Geology*, v. 34, p. 325–328, doi: 10.1130/G22068.1.
- Nance, R.D., Murphy, J.B., and Keppie, J.D., 2002, A Cordilleran model for the evolution of Avalonia: *Tectonophysics*, v. 352, p. 11–31, doi: 10.1016/S0040-1951(02)00187-7.
- Nance, R.D., Miller, B.V., Keppie, J.D., Murphy, J.B., and Dostal, J., 2007, Vestige of the Rheic Ocean in North America: The Acatlán Complex of southern México, in Linnemann, U., Nance, R.D., Kraft, P., and Zulauf, G., eds., *The evolution of the Rheic Ocean: From Avalonian-Cadomian active margin to Alleghanian-Variscan collision*: Geological Society of America Special Paper 423, p. 437–452.
- Nance, R.D., Murphy, J.B., Strachan, R.A., Keppie, J.D., Gutiérrez-Alonso, G., Fernández-Suárez, J., Quesada, C., Linnemann, U., D’Lemos, R., and Pisarevsky, S.A., 2008, Neoproterozoic-early Paleozoic tectonostratigraphy and palaeogeography of the peri-Gondwanan terranes: Amazonian v. West African connections, in Ennih, N., and Liégeois, J.P., eds., *The boundaries of the West African Craton*: Geological Society [London] Special Publication 297, p. 345–383.
- Nutman, A.P., Green, D.H., Cook, C.A., Styles, M.T., and Holdsworth, R.E., 2001, SHRIMP U/Pb zircon dating of the exhumation of the Lizard Peridotite and its emplacement over crustal rocks, Cornwall, England: Constraints for tectonic models: *Journal of the Geological Society*, v. 158, p. 825–836.
- Pickering, K.T., 2008, The destruction of Iapetus and Tornquist’s Oceans: *Geology Today*, v. 5, p. 160–166, doi: 10.1111/j.1365-2451.1989.tb00655.x.
- Pickering, K.T., and Smith, A.G., 1995, Arcs and back-arc basins in the Lower Paleozoic circum-Atlantic: *The Island Arc*, v. 4, p. 1–67, doi: 10.1111/j.1440-1738.1995.tb00132.x.
- Piqué, A., and Skehan, J.W., 1992, Late Paleozoic orogenies in western Africa and eastern North America: The diachronous closure of the Theic Ocean: *Tectonics*, v. 11, p. 392–404, doi: 10.1029/91TC01606.
- Prigmore, J.K., Butler, A.J., and Woodcock, N.H., 1997, Rifting during separation of Eastern Avalonia from Gondwana: Evidence from subsidence analysis: *Geology*, v. 25, p. 203–206, doi: 10.1130/0091-7613(1997)025<0203:RDSOEA>2.3.CO;2.
- Quesada, C., Fonseca, P., Munha, J., Oliveira, J.T., and Ribeiro, A., 1994, The Beja-Acebuches Ophiolite (Southern Iberia Variscan Fold Belt): Geological characterization and geodynamic significance: *Boletín Geológico y Minero*, v. 105, p. 3–49.
- Samson, S.D., 2001, Timing of Alleghanian magmatism revisited: *Geological Society of America Abstracts with Programs*, v. 33, no. 2, p. 7.
- Sánchez-García, T., Bellido, F., and Quesada, C., 2003, Geodynamic setting and geochemical signatures of Cambrian-Ordovician rift-related igneous rocks (Ossa-Morena Zone, SW Iberia): *Tectonophysics*, v. 365, p. 233–255, doi: 10.1016/S0040-1951(03)00024-6.
- Sánchez-Martínez, S., Arenas, R., García, F.D., Martínez Catalán, J.R., Gómez-Barreiro, J., and Pearce, J.A., 2007, Caréon ophiolite, NW Spain: Suprasubduction zone setting for the youngest Rheic Ocean floor: *Geology*, v. 35, p. 53–56, doi: 10.1130/G23024A.1.
- Thorogood, E.J., 1990, Provenance of the pre-Devonian sediments of England and Wales: Sm-Nd isotopic evidence: *Journal of the Geological Society*, v. 147, p. 591–594, doi: 10.1144/gsjgs.147.4.0591.
- Van der Voo, R., 1988, Paleozoic paleogeography of North America, Gondwana, and intervening displaced terranes: Comparisons of paleomagnetism with paleoclimatology and biogeographical patterns: *Geological Society of America Bulletin*, v. 100, p. 311–324, doi: 10.1130/0016-7606(1988)100<0311:PPONAG>2.3.CO;2.
- van Staal, C.R., Dewey, J.F., Mac Niocaill, C., and McKerrow, W.S., 1998, The Cambrian-Silurian tectonic evolution of the Northern Appalachians and British Caledonides: history of a complex, west and southwest Pacific-type segment of Iapetus, in Blundell, D., and Scott, A.C., eds., *Lyell: The past is the key to the present*: Geological Society [London] Special Publication 143, p. 199–242.
- Vega-Granillo, R., Talavera-Mendoza, O., Meza-Figueroa, D., Ruiz, J., Gehrels, G.E., and López-Martínez, M., 2007, Pressure-temperature-time evolution of Paleozoic high-pressure rocks of the Acatlán Complex (southern Mexico): Implications for the evolution of the Iapetus and Rheic Oceans: *Geological Society of America Bulletin*, v. 119, p. 1249–1264, doi: 10.1130/B226031.1.
- Viele, G.W., and Thomas, W.A., 1989, Tectonic synthesis of the Ouachita orogenic belt, in Hatcher, R.D., Jr., Thomas, W.A., and Viele, G.W., eds., *The Appalachian-Ouachita orogen in the United States*: Boulder, Colorado, The Geological Society of America, *Geology of North America*, v. F-2, p. 695–728.
- Winchester, J.A., Pharoah, T.C., and Verniers, J., 2002, Paleozoic amalgamation of Central Europe: An introduction and synthesis of new results from recent geological and geophysical investigations, in Winchester, J.A., Pharoah, T.C., and Verniers, J., eds., *Palaeozoic Amalgamation of Central Europe*: Geological Society [London] Special Publication 201, p. 1–18.
- Wintsch, R.P., Kunk, M.J., Boyd, J.L., and Aleinikoff, J.N., 2003, *P-T* paths and differential Alleghanian loading and uplift of the Bronson Hill terrane, south central New England: *American Journal of Science*, v. 303, p. 410–446, doi: 10.2475/ajs.303.5.410.
- Woodcock, N.H., Soper, N.J., and Strachan, R.A., 2007, A Rheic cause for the Acadian deformation in Europe: *Journal of the Geological Society*, v. 164, p. 1023–1036, doi: 10.1144/0016-76492006-129.
- Wortman, G.L., Samson, S.D., and Hibbard, J.P., 1998, Precise timing constraints on the kinematic development of the Hyco Shear Zone—Implications for the Central Piedmont Shear Zone, southern Appalachian orogen: *American Journal of Science*, v. 298, p. 108–130.

Manuscript received 12 July 2008; accepted 16 October 2008. ☞

## Recommended Reading

GSA Special Paper 423:  
***The Evolution of the Rheic Ocean:  
 From Avalonian-Cadomian Active Margin  
 to Alleghanian-Variscan Collision***  
 U. Linnemann, R.D. Nance, P. Kraft,  
 and G. Zulauf, eds.

Member price: \$115.00 | Non-Member: \$149.00  
 ISBN: 978-0-8137-2423-2

 THE GEOLOGICAL SOCIETY  
 OF AMERICA®

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

# Letter .....

## Dear paleontologists and geologists,

Fifty years ago, R.C. Moore established an endowment to support the compilation and publication of the *Treatise on Invertebrate Paleontology*, to be compiled by the Paleontological Institute at the University of Kansas and jointly published with the Geological Society of America, who would also be responsible for marketing and distribution. This has been a beneficial and rewarding relationship that sustained the *Treatise* for most of those 50 years.

Recently, however, the need has become ever more pressing for the *Treatise* to be put into digital form and, perhaps more importantly, to become a living document for students and research paleontologists. There has been a general sense that this must take place quickly.

When we met with leaders in the paleontological community (see below), it became clear that the *Treatise* needs to be reinvented in some very real senses. Because of the urgency and because of the magnitude of the task of reinvention, those of us involved in the business end of the *Treatise* (the co-signers below, plus GSA Executive Director Jack Hess, GSA Director of Publications Jon Olsen, and Jill Hardesty, managing editor of the *Treatise*) concluded that the current relationship between the Paleontological Institute and the Geological Society of America may be more of a hindrance than an advantage at this point in time. Therefore, we have decided that the best way forward, at least for the time being, is for the Paleontological Institute to take over all operations with respect to the *Treatise*.

This should in no way be construed as a lack of commitment on the part of the Geological Society of America to the paleontological community and to the *Treatise*. Indeed, GSA called this leadership meeting, and we note that GSA's current president, Judith Totman Parrish, has very close ties to the paleontological community, having published numerous papers with paleontological and paleobiological content, and, finally, some 20% of GSA members are paleontologists. Rather, GSA is assuming the same role as other geological societies and paleontological societies as an interested party to whom the Paleontological Institute might look for intellectual and financial support as appropriate. This change was necessary to allow the Paleontological Institute to proceed unfettered and to perform the reinvention of the *Treatise* with the greatest speed. GSA would like to emphasize that the door remains open for the *Treatise* to utilize GSA's expertise in publication, distribution, and education and outreach at some future date if such expertise would be beneficial.

We believe that the future of the *Treatise* is bright and are looking forward to seeing its reinvention as a twenty-first-century resource.

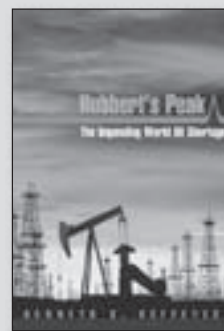
Regards,

**Judith Totman Parrish**  
President, The Geological  
Society of America

**Paul Selden**  
Director, Paleontological  
Institute

**Robert H. Goldstein**  
Chair and Professor,  
Dept. of Geology,  
University of Kansas

**Leadership Group:** Warren Allmon, GSA *Treatise* Committee; Doug Erwin, President, Paleontological Society; Bob Goldstein, Chair and Professor, Dept. of Geology, University of Kansas; Joe Hannibal, GSA *Treatise* Committee; Jill Hardesty, *Treatise* Managing Editor; Howard Harper, Society for Sedimentary Geology (SEPM) Executive Director; Jack Hess, GSA Executive Director; Steve Hasiotis, SEPM; Jon Olsen, GSA Director of Publications; Tim Palmer, Palaeontological Association; Lisa Park, GSA *Treatise* Committee; Judy Parrish, GSA President; Paul Selden, Director, Paleontological Institute, University of Kansas; Paul Taylor, Palaeontographical Society; Roger Thomas, The Paleontological Society; and Richard Twitchett, Palaeontological Association.



With new commentary by the author

### Hubbert's Peak

The Impending World Oil Shortage

Kenneth S. Deffeyes

In 2001, Kenneth Deffeyes made a grim prediction: oil production would reach a peak within the next decade—and there was nothing anyone could do to stop it. In this updated edition of *Hubbert's Peak*, Deffeyes explains the crisis that few now deny we are headed toward. Using geology and economics, he shows how everything from the rising price of groceries to the subprime mortgage crisis has been exacerbated by the shrinking supply—and growing price—of oil.

Paper \$16.95 978-0-691-14119-0



### Geochemical Kinetics

Youxue Zhang

This book offers a comprehensive exploration of geochemical kinetics—the application of chemical kinetics to geological problems, both theoretical and practical. *Geochemical Kinetics* balances the basic theories of chemical kinetics with a thorough examination of advanced theories developed by geochemists, such as nonisothermal kinetics and inverse theories, including geochronology, thermochronology, and geospeedometry.

Cloth \$70.00 978-0-691-12432-2



PRINCETON  
UNIVERSITY  
PRESS

# 2009 GSA Division Awards

Nominations are requested for the following GSA Division awards, listed in order by nomination deadline. These awards will be presented at the 2009 GSA Annual Meeting in Portland, Oregon, USA.

All funds are administered by the GSA Foundation.



Recognition

Leadership

SERVICE

STEWARDSHIP

Networking

SCIENCE

Mentoring



THE GEOLOGICAL SOCIETY OF AMERICA®

SCIENCE ■ STEWARDSHIP ■ SERVICE

## BIGGS AWARD FOR EXCELLENCE In Earth Science Teaching Award Geoscience Education Division

The Biggs Award recognizes innovative and effective teaching in college-level earth science. Earth-science instructors and faculty members from any academic institution engaged in undergraduate education who have been teaching full-time for 10 years or fewer are eligible (part-time teaching is not counted in the 10-years-or-fewer requirement). Both peer- and self-nominations are accepted for this award.

The US\$750 award is made possible by support from the Donald and Carolyn Biggs Fund, the GSA Geoscience Education Division, and GSA's Education and Outreach Program. An additional travel reimbursement of up to US\$500 is available to the recipient to enable him or her to attend the award presentation at the GSA Annual Meeting.

**Send nominations by 1 February 2009** to Paul Baldauf, Nova Southeastern University, Math, Science, and Technology Division, 3301 College Avenue, Fort Lauderdale, FL 33314, USA, pb501@nova.edu. To access the nomination form, please go to [www.geosociety.org/awards/biggs.htm](http://www.geosociety.org/awards/biggs.htm).

## MARY C. RABBITT HISTORY OF GEOLOGY AWARD

### History of Geology Division

The Mary C. Rabbitt History of Geology Award, established in 1981 and renamed in 2005 to honor Rabbitt, is presented annually for exceptional scholarly contributions of fundamental importance to understanding the history of the geological sciences. Neither the nominator nor the nominee need be members of the Division or of GSA. Achievements deserving of the award include, but are not limited to, publication of papers or books that contribute new and profound insights into the history of geology based on original research or a synthesis of existing knowledge. For more information, please go to <http://gsahist.org/HoGaward/awards.htm>.

**Send nominations by 1 February 2009** to Stephen M. Rowland, University of Nevada, Dept. of Geoscience, Box 454010, Las Vegas, NV 89154-4010, [steve.rowland@unlv.edu](mailto:steve.rowland@unlv.edu).

## GEORGE P. WOOLLARD AWARD

### Geophysics Division

The annual George P. Woollard Award recognizes outstanding contributions to geology through the application of the principles and techniques of geophysics. A highlight of this award's presentation is the honorary George P. Woollard Technical Lecture by the recipient before the award ceremony. Nominations should include a description of the nominee's specific contributions and their scientific impact.

**Submit nominations online by 15 February 2009** at [http://geoscience.unlv.edu/pub/GSA\\_Geop/woollard.html](http://geoscience.unlv.edu/pub/GSA_Geop/woollard.html).

## LAURENCE L. SLOSS AWARD FOR SEDIMENTARY GEOLOGY

### Sedimentary Geology Division

This award is given annually to a sedimentary geologist whose lifetime achievements best exemplify those of Larry Sloss—achievements that contribute widely to the field of sedimentary geology and service to GSA. Nominations, to be considered by the Sedimentary Geology Division's management board, should include a cover letter describing the nominee's accomplishments in sedimentary geology and contributions to GSA, along with a curriculum vitae.

**Send nominations electronically by 20 February 2009** to Paul Link, Sedimentary Geology Division, [linkpaul@isu.edu](mailto:linkpaul@isu.edu).

## CALL FOR NOMINATIONS

### GILBERT H. CADY AWARD

#### Coal Geology Division

The Gilbert H. Cady Award, established in 1973 in honor of Cady, recognizes outstanding contributions that advance the field of coal geology.

Nominations, which will be evaluated by the Gilbert H. Cady Award Panel, should include the name, office or title, and affiliation of the nominee; date and place of birth; education, degree(s), and honors and awards; major events in his or her professional career; and a brief bibliography noting outstanding achievements and accomplishments that warrant nomination.

**Send three copies of the nomination by 28 February 2009** to Glenn Stracher, East Georgia College, Division of Science & Mathematics, 131 College Circle, Swainsboro, GA 30401-3643, USA; +1-478-289-2073; stracher@ega.edu.

### DON J. EASTERBROOK DISTINGUISHED SCIENTIST AWARD

#### Quaternary Geology and Geomorphology Division

The Don J. Easterbrook Distinguished Scientist Award recognizes excellence in published research, as demonstrated by a single paper of exceptional merit or a series of papers that have substantially increased knowledge in Quaternary geology or geomorphology. The recognition is normally extended to an individual, but in the event of particularly significant research, two people may share the award. No time limitations apply to the recognized research.

Although recognition of extraordinary prior research excellence is the principal goal of this award, a second consideration of this award is the opportunity to fund additional research. The Easterbrook Distinguished Scientist is eligible to draw funds for further research from the GSA Easterbrook Fund, administered by the GSA Foundation.

Nominees need not be members of the Quaternary Geology and Geomorphology Division. Because the award primarily recognizes research excellence, self-nomination is not allowed. Nominations must be accompanied by supporting documentation, including a statement of the significance of the nominee's research, a curriculum vitae, letters of support, and any other documents deemed appropriate by the nominating committee.

**Send nominations by 2 April 2009** to Marith Reheis, U.S. Geological Survey, MS 980, Federal Center, P.O. Box 25046, Denver, CO 80225-0046, USA; +1-303-277-1843; mreheis@usgs.gov.

### FAROUK EL-BAZ AWARD FOR DESERT RESEARCH

#### Quaternary Geology and Geomorphology Division

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 (US\$10,000 anticipated for 2009) 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 for this award, and neither nominators nor nominees need be GSA members. Because the award recognizes research excellence, self-nomination is not permitted. Nominations must be accompanied by a statement of the significance of the nominee's research, a curriculum vitae, letters of support, and documentation of published research results that have significantly advanced the knowledge of the Quaternary geology and geomorphology of desert environments.

**Send nominations by 2 April 2009** to Paul R. Bierman, University of Vermont, Dept. of Geology, Delehanty Hall, Burlington, VT 05405-0001, USA; +1-802-656-4411; pbierman@zoo.uvm.edu.

## Call for Applications

### 2009–2010 GSA-USGS CONGRESSIONAL SCIENCE FELLOWSHIP



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

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

Find application information at [www.geosociety.org/csf](http://www.geosociety.org/csf) or contact Ginger Williams, +1-303-357-1040, [gwilliams@geosociety.org](mailto:gwilliams@geosociety.org). **Deadline for application: 1 February 2009.**

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

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



# UPCOMING AWARD, RECOGNITION & GRANT DEADLINES



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

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

---

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

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

Nomination deadline: **1 February 2009**.

---

## GSA Fellowship

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

Nomination deadline: **1 February 2009**.

---

## AGI Medal in Memory of Ian Campbell

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

---

## John C. Frye Environmental Geology Award

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

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

Nomination deadline: **31 March 2009**.

---

## 2009 National Awards

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

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

Nomination deadline: **1 February 2009**.

---

## 2009 Student Research Grants

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

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

---

## 2009 Post-Doctoral Research Awards

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

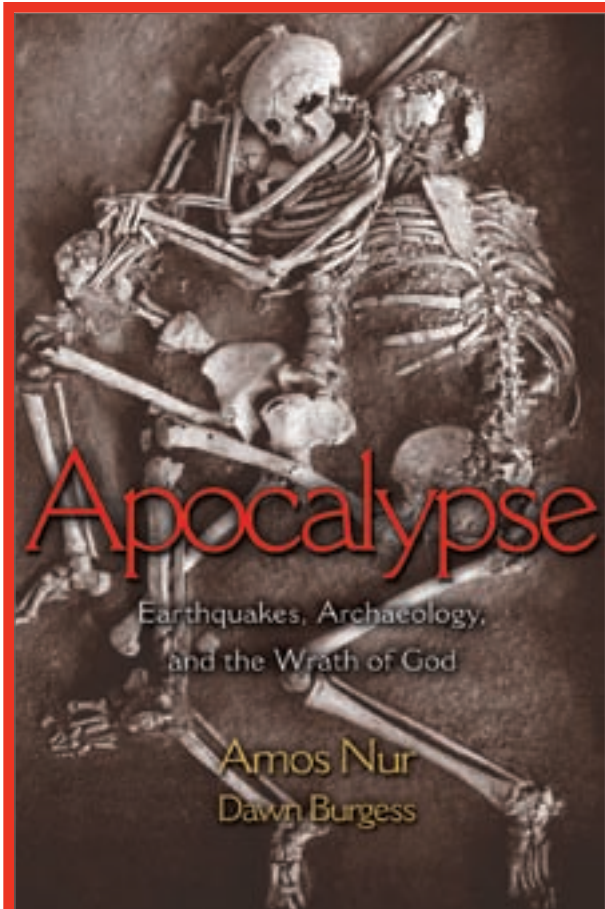
- **The Gladys W. Cole Memorial Research Award** for research on the geomorphology of semiarid and arid terrains in the United States and Mexico is awarded annually to a GSA Member or Fellow between 30 and 65 years of age who has published one or more significant papers in geomorphology. 2009 award: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

Application deadline for either award: **1 February 2009**.



THE GEOLOGICAL SOCIETY  
OF AMERICA®





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

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

**\*\*AVAILABLE NOW ONLINE AT AMAZON.COM OR ORDER / BUY FROM YOUR LOCAL BOOKSTORE\*\***

## As a member of the Geological Society of America, you are eligible for the Subaru VIP Purchase Program.

**No haggling, no negotiation, no pressure - just a great deal on a brand new Subaru!**

Save between \$1,300 - \$3,300 off the Manufacturer's Suggested Retail Price\* (depending on model and accessories) plus any applicable incentives on the purchase or lease of a new Subaru, including Subaru Tribeca, Legacy, Outback, Forester, Impreza, WRX and STI models, from participating dealers.

To qualify, you must be a GSA member in good standing for at least six consecutive months prior to participation in this program. Please contact GSA Sales and Service at 1-888-443-4472 or 1-303-357-1000 option 3, or [gsaservice@geosociety.org](mailto:gsaservice@geosociety.org) to receive your Dealer Visit Authorization form **before** visiting your local Subaru dealer.

Access [Subaru.com](http://Subaru.com) to find a nearby dealer or learn more about Subaru vehicles.



**Outback® See more at [subaru.com](http://subaru.com)**

\*MSRP does not include tax, title and registration fees.  
Subject to change without notice. Terms and conditions apply.



## GSA Adopts New Strategic Plan

*Judith Totman Parrish, President*

If you're like a lot of people, the very words *strategic plan* make your eyes glaze over. But hang in here with me for a little bit.

Strategic plans don't have to be hopeless. A well-written strategic plan can be vital for helping make decisions in resource-limited (read: *ALL*) environments and can serve as benchmarks for measuring progress.

A few years ago, GSA Council and headquarters staff rewrote GSA's strategic plan. Mindful that the HQ staff uses the strategic plan explicitly in implementing the vision of Society members through their representatives on Council, we worked to make it a document that pointed in specific directions and could therefore be used in decision making.

On 8 October 2008, GSA Council adopted a new strategic plan, setting new directions for the Society under seven major goals, including leadership in education and outreach, public policy, and globalization of the Society. The new strategic plan can be read at [www.geosociety.org/aboutus/stratplan.htm](http://www.geosociety.org/aboutus/stratplan.htm).

For the past four years, GSA's executive director has been charged with reporting progress on the strategic plan to the Executive Committee and Council, and he has done so with a running documentation of each year's accomplishments. At the recent annual ExCom retreat, when the executive director made his presentation, it occurred to me that we had indeed written a document that was not only useful but that had guided us remarkably well in reassessments and decisions over the past four years.

With the adoption of a new strategic plan, this seems a good time to make the progress report—in all its lengthy detail—available to the membership at large. For each goal and objective, we have a four-year record of progress and successes, as well as a few failures and reassessments, all of which were examined closely in the formulation of the new strategic plan.

The progress report can be read at [www.geosociety.org/aboutus/08stratPlanProgress.pdf](http://www.geosociety.org/aboutus/08stratPlanProgress.pdf). I hope that you will take the time to read at least a portion of this document to see that GSA's HQ staff and Council, along with myriad other individuals and entities that make up the governance structure of the GSA, have been deliberate and successful in carrying out the vision and mission of the Society. I believe this is a large part of the reason that the health of GSA is outstanding and that we are increasingly recognized as a leading geological society in the world.



SCIENCE ■ STEWARDSHIP ■ SERVICE

## GeoCorps™ America: Geoscience Opportunities on Public Lands

Applications for **GeoCorps™ America 2009** are now being accepted. All geoscientists—from undergraduate students to retirees—are encouraged to participate!

See our Web site for position descriptions and application details.

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

Apply Today!



Brina Mocsny, GeoCorps Education Specialist and Cave Technician at Craters of the Moon National Monument, 2008.



# Rock Solid

## Meiji Techno MT Series Polarizing Microscopes

Meiji Techno introduces the all new MT9000 Series Polarizing Microscopes. The MT9000 Series feature new improved optics and an all new frame with improved stability and ergonomics.



Optional Point Counting Stage



Point Counting Stage has 4 sets of point clicking knobs: 0.1, 0.2, 0.5mm and no click

Binocular and trinocular models are available along with a full range of accessories including an optional Point Counting Stage.

Each model includes DIN standard strain-free objectives, Bertrand lens, 1/4 wave plate, first order red plate and larger, ceramic-coated stage.

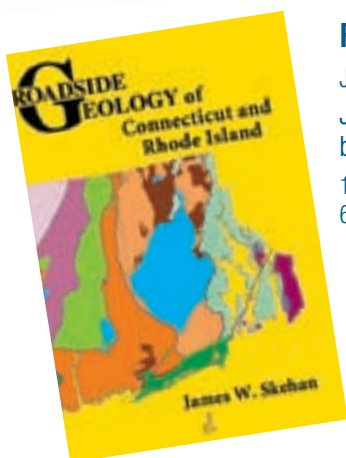
## MEIJI TECHNO AMERICA

3010 Olcott Street, Santa Clara, CA 95054-3027

Toll Free Telephone: 800.832.0060 or visit our website at [www.meijitechno.com](http://www.meijitechno.com)

## NEW Roadside Geology books from Mountain Press. . .

Now with **FULL COLOR** photos and illustrations



### Roadside Geology of Connecticut and Rhode Island

James W. Skehan

Journey through time and discover enormous mountains, tropical beaches, and fiery volcanoes.

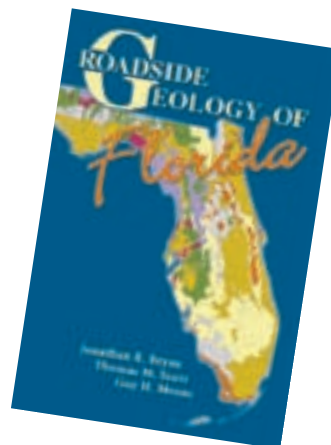
135 color photographs • 103 two-color maps and illustrations • 304 pages  
6 x 9 • paper \$26.00 • ISBN: 978-0-87842-547-1 • Item No. 236

### Roadside Geology of Florida

Jonathon R. Bryan, Thomas M. Scott, and Guy H. Means

Explore the fascinating and varied geology of the Sunshine State.

72 figures and maps • 112 color and 95 b&w photographs • 368 pages  
6 x 9 • paper \$26.00 • ISBN: 978-0-87842-542-6 • Item No. 235



## MOUNTAIN PRESS PUBLISHING COMPANY

P.O. Box 2399 / Missoula, MT 59806 / 406-728-1900 / FAX 406-728-1635

1-800-234-5308 / E-MAIL [info@mtnpres.com](mailto:info@mtnpres.com) / WEB [www.mountain-press.com](http://www.mountain-press.com)

# Renew

Renew before  
15 December  
2008 to  
**Save  
15%**

your GSA Membership for 2009

21,000+ Members — 17 Special Interest Divisions — 45 Associated Societies

## The GSA Membership Advantage:

- ❖ Premier journals (FREE online access for students)
- ❖ Publish and present your research
- ❖ Scientific exchanges (special pricing and opportunities for students)
  - GSA meetings
  - Special interest Divisions
- ❖ Member-only discounts
  - Meetings
  - Journals
  - Online bookstore
- ❖ Public policy updates
- ❖ Student research funding
- ❖ Mentor and employment programs
- ❖ GeoCorps™ America—field projects
- ❖ *GSA Today* and *GSA Connection* subscriptions

Join special interest Divisions and additional Sections, and support the GSA Foundation when you renew.



Photo by Jason Gully

Renew &  
Subscribe at

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

# Subscribe

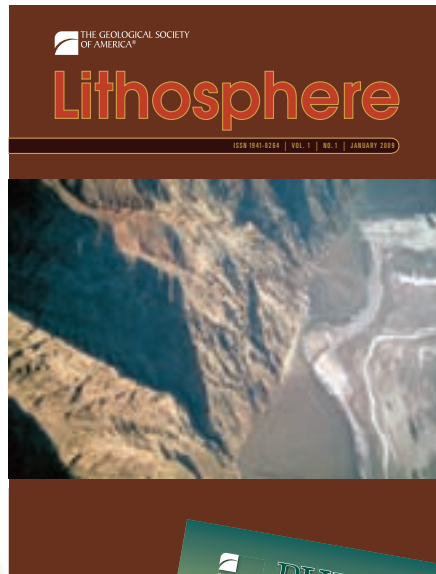
to cutting-edge science publications

Full-year subscriptions *or* Buy only the science you want and need with GSA Bloc of Docs

**New in 2009**

## *Lithosphere*

- Print
- Online
- Annual CD-ROM



## *Geology*

- Print
- Online
- Annual CD-ROM
- Archive 1973–2008

## *GSA Bulletin*

- Print
- Online
- Annual CD-ROM
- Archive 1945–2008

## *Geosphere*

- Online only
- Annual CD-ROM
- Archive 2005–2008

## *Environmental & Engineering Geoscience*

- Print
- Online



Subscribe • Submit Your Manuscript • Search Current Issues & Archives  
Purchase Articles (Individually or via Bloc of Docs)

[www.gsajournals.org](http://www.gsajournals.org)

# Call for Proposals

## GSA's 2009 Annual Meeting & Exposition

# From Volcanoes to Vineyards:

## Living with Dynamic Landscapes

18-21 October \* Portland, Oregon, USA  
[www.geosociety.org/meetings](http://www.geosociety.org/meetings)

Here is your chance to have real input for next year's annual meeting: Play a key role by proposing a topical session! Get involved starting now to help maximize your meeting experience and that of others. ***This is your meeting.***

Have you ever been frustrated to find that none of the topical sessions at a GSA meeting represent your own current area of research and excitement? If so, there is an easy answer: Propose a session yourself! The topical sessions at GSA meetings are planned entirely by your friends and colleagues. If these sessions do not adequately reflect your own interests, your voice is needed.

***The reward is great:*** You play a direct role in attracting key people to the meeting and in formulating part of the program that will be of direct benefit to you. Yours might even be the session that has everyone talking in the corridors and the bars, or even on the evening news! You may also be well on your way to producing the next GSA Special Paper.

**2009 Technical Program Chair:** Dick Berg, +1-217-244-2776, [berg@isgs.uiuc.edu](mailto:berg@isgs.uiuc.edu).

### PROGRAM OPPORTUNITIES

#### Topical Sessions

Please submit your proposals electronically on or before **6 January 2009** via the link at [www.geosociety.org](http://www.geosociety.org). Topical



Photo of USGS scientist conducting electronic distance measurement, South Sister Volcano, Oregon, by Lyn Topinka; used with permission of USGS. Wonderglobe: Background Earth image produced by Reto Stöckli; used with permission of NASA. Inside globe images: Mount Hood, Portland, Oregon; image courtesy Travel Portland. Erupting volcano photo by Ulrich. Photos of Delicate Arch, Arches National Park, Utah; Echinus Geyser, Yellowstone National Park; flash flood, Death Valley; and Great Sand Dunes, Colorado by John Karachewski.

sessions promote the exchange of timely and/or state-of-the-art information with respect to a focused topic and allow scheduling of interdisciplinary talks that bear specifically on that topic. Organizers (advocates) may request specific papers to ensure a successful session and are encouraged to solicit volunteered contributions. Advocates may invite up to three speakers or poster presenters and are encouraged to solicit volunteered abstracts for the topical session as well, so that a session includes a mixture of requested and volunteered abstracts. Once a topical session is approved, volunteered abstracts will also be solicited in *GSA Today*. Topical sessions must receive a minimum of 12 abstracts to be part of the technical program. Advocates are encouraged to submit their proposals as poster sessions to accommodate the growing technical program. All session proposals are reviewed by the Joint Technical Program Committee (JTPC).

### Pardee Keynote Symposia

Pardee Keynote Symposia, which are special events of broad interest to the geoscience community, are made possible by a grant from the Joseph T. Pardee Memorial Fund.

**New this year:** The Annual Program Committee (APC) plans to take a proactive role in selecting topics and soliciting conveners for Pardee Keynote Symposia in order to enhance the range and significance of science presented at the annual meeting and to highlight topics of particular relevance to the Portland meeting location.

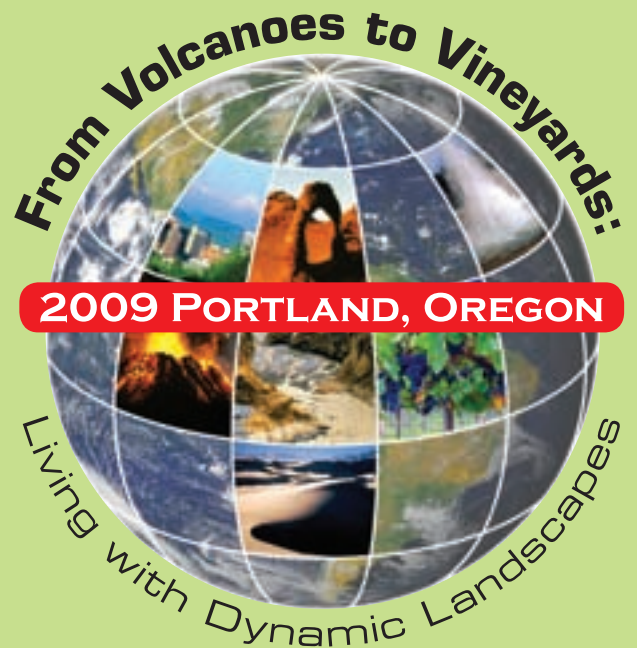
As always, we expect these topics to be on the leading edge in scientific disciplines or public policy and to address broad, fundamental issues. We want to stress that the ideas will not be limited to those of just the APC; we highly encourage GSA Divisions and Associated Societies to pool their resources and submit ideas related to new breakthroughs and transformative science within their specialty areas. We also encourage members to work with GSA Divisions and Associated Societies to come up with Pardee Keynote Symposia topics.

**Also new this year** is the opportunity to suggest a different session format for any Pardee Keynote Symposium that you propose. Symposia may include only two or three speakers, or they may revolve around a technical panel discussion. They can follow a typical half-day session format, or you might only want them to fill a two-hour slot. You have the flexibility to create a session that works best for the topic at hand.

We encourage you to suggest topics for Pardee Symposia by writing to Nancy Wright at [nwright@geosociety.org](mailto:nwright@geosociety.org). Again, the deadline to submit your ideas is **6 January 2009**.

### Oral and Poster General Sessions

Consisting entirely of volunteered papers, these sessions are an important component of the GSA Annual Meeting. The number of abstracts received determines the number of general sessions in each discipline. The goal of the Technical Program Chair and JTPC representatives is to provide presenters with the best possible opportunity for communicating new scientific information rather than to dictate what can or will be presented. To allow for well-attended, dynamic sessions, an



**Technical Program:** 18–21 October 2009

**Proposal Deadline:** 6 January 2009

**Submit Proposals** at [www.geosociety.org](http://www.geosociety.org)



effort will be made in scheduling to avoid overlap of poster and oral sessions in the same discipline.

### Hot Topics

The focus of these popular lunchtime forums, held Sunday through Wednesday, is on discussion—with plenty of audience participation. Depending on the subject, a debate format is recommended; panels are discouraged, and each session must have a moderator. Titles should be catchy and provocative. If you are interested in organizing a hot-topic session, contact Melissa Cummiskey, [mcummiskey@geosociety.org](mailto:mcummiskey@geosociety.org).

### PORTLAND 2009 DATES AND DEADLINES

6 January	Session proposals due by midnight Pacific Standard Time
April	Electronic abstract form posted at <a href="http://www.geosociety.org">www.geosociety.org</a> First announcement in <i>GSA Today</i>
June	Second announcement in <i>GSA Today</i>
11 August	Abstracts due by midnight, Pacific Standard Time
31 August	Technical program schedule finalized
mid-September	Accepted abstracts with links to speakers and titles posted online

# 2009

## **GSA Section Meeting Calendar**

### **Southeastern Section**

St. Petersburg, Florida, USA  
12–13 March

**Abstract deadline:**

9 December 2008

### **South-Central Section**

Dallas, Texas, USA  
16–17 March

**Abstract deadline:**

9 December 2008

### **Northeastern Section**

Portland, Maine, USA  
22–24 March

**Abstract deadline:**

16 December 2008

### **North-Central Section**

Rockford, Illinois, USA  
2–3 April

**Abstract deadline:**

30 December 2008

### **Cordilleran Section**

Kelowna, British  
Columbia, Canada  
7–9 May

**Abstract deadline:**

3 February 2009

### **Rocky Mountain Section**

Orem, Utah, USA  
11–13 May

**Abstract deadline:**

3 February 2009



THE  
GEOLOGICAL  
SOCIETY  
OF AMERICA®

**Plan your 2009  
Section Meeting  
attendance today!**

## **Preliminary Announcement and Call for Papers**

# **CORDILLERAN**

## **105th Annual Meeting**

**Kelowna, British Columbia, Canada**

**7–9 May 2009**



Kelowna, British Columbia, Canada. Photo courtesy Tourism Kelowna–SATW.

GSA's Cordilleran Section will meet on the University of British Columbia–Okanagan campus in Kelowna, British Columbia. Kelowna is ~400 km east of Vancouver, situated along Okanagan Lake in the Okanagan Valley. This valley is the northernmost extension of the Sonora Desert, and therefore is known for its unique geology and environment, including mountains, beaches, orchards, and vineyards. Kelowna is also the center of the Canadian diamond industry. Field trips in conjunction with this meeting will observe local geology associated with Cenozoic rifting and volcanism, local mining activity, surface and groundwater research in this semiarid basin, glacial geology at the edge of the Channelled Scablands, and the Burgess Shales area on the 100th anniversary of their discovery.

### **CALL FOR PAPERS**

**Abstract Deadline:** 3 February 2009

Please submit your abstract online via link at [www.geosociety.org/meetings/](http://www.geosociety.org/meetings/); an abstract submission fee of US\$10 will be charged. For expanded meeting information, check our Web site or contact the local committee chair, Robert Young, at [robert.young@ubc.ca](mailto:robert.young@ubc.ca).

**Registration Deadline:** 6 April 2009

**Cancellation Deadline:** 13 April 2009



# 2009 Section Meeting Mentor Programs

*Missed the annual meeting  
mentor programs?*

*Didn't want them to end?*



Plan now to attend one or more of the following mentor luncheons at your 2009 Section Meeting.

## MEET YOUR CAREER MENTORS

Chat one-on-one with practicing geoscientists. Our quality group of volunteer mentors will answer your questions and share insights on how to get a job after graduation. Space for these events is limited, so plan to arrive early. If you have questions, please contact Jennifer Nocerino, [jnocerino@geosociety.org](mailto:jnocerino@geosociety.org). *Both programs are sponsored by the GSA Foundation.*

## DESCRIPTIONS

### **Roy J. Shlemon Mentor Program in Applied Geoscience**

This luncheon provides an occasion for students to discuss career opportunities and challenges with professional geoscientists from multiple disciplines. Students will receive tickets for this FREE lunch in their meeting registration packets.

### **John Mann Mentors in Applied Hydrogeology Program**

This event presents opportunities for students and recent graduates interested in a career in applied hydrogeology or hydrology to network with practicing professionals. Whether you've already decided to head down the hydro career path or would just like to know more about career options, this luncheon is for you! Students will receive a ticket for this focused, small-scale event and FREE lunch in their meeting registration packets.



SCIENCE ■ STEWARDSHIP ■ SERVICE

## **SOUTHEASTERN**

St. Petersburg, Florida, USA

### **Shlemon Mentor Program Luncheons**

Thurs., 12 March, 11:30 a.m.–12:30 p.m.  
**and** 12:30–1:30 p.m.

### **Mann Mentors in Applied Hydrogeology Luncheon**

Fri., 13 March, 11:30 a.m.–1 p.m.

## **SOUTH-CENTRAL**

Dallas, Texas, USA

### **Shlemon Mentor Program Luncheon**

Mon., 16 March, 11:30 a.m.–1 p.m.

### **Mann Mentors in Applied Hydrogeology Luncheon**

Tues., 17 March, 11:30 a.m.–1 p.m.

## **NORTHEASTERN**

Portland, Maine, USA

### **Shlemon Mentor Program Luncheons**

Mon., 23 March, 11:30 a.m.–12:30 p.m.  
**and** 12:30–1:30 p.m.

### **Mann Mentors in Applied Hydrogeology Luncheon**

Tues., 24 March, 11:30 a.m.–1 p.m.

## **NORTH-CENTRAL**

Rockford, Illinois, USA

### **Shlemon Mentor Program Luncheons**

Fri., 3 April, 11:30 a.m.–12:30 p.m.  
**and** 12:30–1:30 p.m.

### **Mann Mentors in Applied Hydrogeology Luncheon**

Thurs., 2 April, 11:30 a.m.–1 p.m.

## **CORDILLERAN**

Kelowna, British Columbia, Canada

### **Shlemon Mentor Program Luncheons**

Thurs., 7 May, 11:30 a.m.–12:30 p.m.  
**and** 12:30–1:30 p.m.

### **Mann Mentors in Applied Hydrogeology Luncheon**

Fri., 8 May, 11:30 a.m.–1 p.m.

## **ROCKY MOUNTAIN**

Orem, Utah, USA

### **Shlemon Mentor Program Luncheon**

Mon., 11 May, 11:30 a.m.–1 p.m.

### **Mann Mentors in Applied Hydrogeology Luncheon**

Tues., 12 May, 11:30 a.m.–1 p.m.

## SOUTH-CENTRAL

43rd Annual Meeting  
Dallas (Richardson), Texas, USA

16–17 March 2009



The Dallas–Fort Worth metropolitan area is the largest in Texas. This astronaut photograph captures the northwestern portion of the metropolitan area, including Lake Lewisville and Grapevine Lake. Astronaut photograph ISS010-E-24596 from 14 April 2005, provided by the International Space Station Crew Earth Observations experiment and the Image Science & Analysis Group, Johnson Space Center.

### LOCATION AND CONTACT INFORMATION

The meeting will take place at the conference center on the University of Texas at Dallas campus, 800 W. Campbell Road, Richardson, Texas 75080, USA.

Find details on field trips, workshops, student opportunities, the guest program, symposia and theme sessions, and additional hotels at [www.geosociety.org/meetings/](http://www.geosociety.org/meetings/).

For further information, or if you have special requirements, please contact the meeting chairs: local committee chair John Ferguson, [ferguson@utdallas.edu](mailto:ferguson@utdallas.edu), or technical program chair Bob Stern, [rjstern@utdallas.edu](mailto:rjstern@utdallas.edu).

### Special Thanks to These GSA South-Central Sponsors!

Pioneer Natural Resources	Nexen
Denbury Resources Inc.	The Dallas Geological Society
XTO Energy	Forth Worth Geological Society
EnCana	

### REGISTRATION

**Early Registration Deadline:** 9 February 2009

Please register at [www.geosociety.org/meetings/](http://www.geosociety.org/meetings/). Please note that **GSA will distribute all badges at the meeting**; no badges will be mailed.

REGISTRATION FEES	Early	Standard	One-day
Professional Member*	US\$120	US\$140	US\$90
Professional Nonmember*	US\$130	US\$150	US\$100
Student Member*	US\$50	US\$60	US\$40
Student Nonmember*	US\$55	US\$65	US\$45
Professional Member 70+*	US\$60	US\$70	US\$50
K–12 Teacher*	US\$35	US\$40	US\$30
Guest or Spouse	US\$30	US\$35	N/A
Field Trip or Workshop only	US\$20	US\$25	N/A

\*Includes box lunch for each day of registered attendance.

### On-Site Registration & Registration Packet Pickup Schedule

Sunday, 15 March 4–7:30 p.m.  
Monday, 16 March 7:30 a.m.–5 p.m.  
Tuesday, 17 March 7:30 a.m.–noon

In recognition of the fact that states in northeastern Mexico have just been added to the GSA South-Central Section, registration fees will be waived for geoscientists and students who are either employed or enrolled in Mexico (as evidenced by passport and/or other official ID). In addition, special arrangements have been made to provide financial support for Mexican geoscientists who are first author and presenting a paper or poster at the meeting. Please contact John Ferguson at [ferguson@utdallas.edu](mailto:ferguson@utdallas.edu), Bob Stern at [rjstern@utdallas.edu](mailto:rjstern@utdallas.edu), or Gabriel Chavez Cabello at Universidad Autónoma de Nuevo León, [gabchave2001@yahoo.com.mx](mailto:gabchave2001@yahoo.com.mx), for further details.

### Cancellations, Changes, and Refunds

Requests for additions, changes, and cancellations must be received at GSA Headquarters by **17 February 2009**. No refunds will be made on cancellation notices received after this date.

### ACCOMMODATIONS

**Hotel Registration Deadline:** 21 February 2009

Make your reservations via [www.geosociety.org/meetings/](http://www.geosociety.org/meetings/) using reservation code “2009 GSA South-Central Meeting.”

### CALL FOR PAPERS

**Abstract deadline:** 9 December 2008

**Fee:** US\$10

**Technical Program Chair:** Bob Stern, [rjstern@utdallas.edu](mailto:rjstern@utdallas.edu)

### Theme Sessions

- Permian to Jurassic Tectonics, Magmatism, and Sedimentation in the NE Mexico and South-Central USA Region.** Rafael Barboza, Universidad Autónoma de San Luis Potosí, [rbarboza@uaslp.mx](mailto:rbarboza@uaslp.mx); William R. Dickinson, University of Arizona, [wrDickin@dakotacom.net](mailto:wrDickin@dakotacom.net); Alexander Iriondo, Universidad Nacional Autónoma de México Campus Juriquilla, [iriondo@dragon.geociencias.unam.mx](mailto:iriondo@dragon.geociencias.unam.mx); Timothy F. Lawton, New Mexico State University,

- tlawton@nmsu.edu; Gabriel Chávez Cabello, Universidad Autónoma de Nuevo León.
- Geology and Health Issues in Texas, Mexico, and Beyond.** Bob Finkelman, University of Texas at Dallas, bobf@utdallas.edu; Joseph Oppong, University of North Texas, oppong@unt.edu.
  - Trans-Pecos Volcanic Province.** Elizabeth Anthony, University of Texas at El Paso (UTEP), eanthony@utep.edu; Don Parker, Baylor University, don\_parker@baylor.edu; Minghua Ren, UTEP, ren@geo.utep.edu; Dan Miggins, USGS/UTEP, dmiggins@usgs.gov.
  - Water Resource Challenges and Opportunities in North-Central Texas and Surrounding Regions.** Tom Brikowski, University of Texas at Dallas, brikowski@utdallas.edu; Jack Sharp, University of Texas at Austin, jmsharp@mail.utexas.edu.
  - Geology and Public Policy Forum: Resource Planning and Geoscientific Input.** Wendi Williams, University of Arkansas, wjwillia@uark.edu; Jack Sharp, University of Texas at Austin, jmsharp@mail.utexas.edu; Tom Brikowski, University of Texas at Dallas, brikowski@utdallas.edu.
  - Shale Reservoirs—Giant Hydrocarbon Resources for the 21st Century.** John A. Breyer, Texas Christian University (TCU), j.breyer@tcu.edu; Daniel M. Jarvie, Worldwide Geochemistry and TCU Energy Institute, danjarvie@wwgeochem.com.
  - A View from the Craton Southward into the Gulf of Mexico: The Geology and Geophysics of Transitions: Celebrating the Career of R.E. (Tim) Denison.** G.R. Keller, University of Oklahoma, grkeller@ou.edu; M. Cloos, University of Texas at Austin, cloos@mail.utexas.edu.
  - Recent Advances in Geology, Geochemistry and Biostratigraphy of the Permian Basin, Texas and New Mexico.** M.K. Nestell, University of Texas at Arlington, nestell@uta.edu; P.J. Noble, University of Nevada–Reno, noblepj@unr.edu.
  - Undergraduate Research (Posters).** *Sponsored by the Council on Undergraduate Research, Geosciences Division.* Mon., 16 March. Diane Smith, Trinity University, dsmith@trinity.edu, +1-210-999-7656.

## FIELD TRIPS

For an extended list of field trips and descriptions, go to [www.geosociety.org/meetings/](http://www.geosociety.org/meetings/).

### Pre-meeting

- Trans-Pecos (Big Bend) Volcanic Province Field Trip.** Thurs.–Sun., 12–15 March. Elizabeth Anthony, University of Texas at El Paso (UTEP); Don Parker, Baylor University; Minghua Ren, UTEP; Don Miggins, USGS/UTEP. This trip will be staging from the El Paso airport for those traveling by air to Dallas after the field trip. Groups and individuals traveling by road can join the field trip in Alpine, Texas. No unofficial vehicles will be permitted on the trip beyond Alpine. Cost: US\$300; US\$200 students. Min.: 15; max.: 32.
- Sedimentology and Structure of Terrestrial to Shallow Marine Outcrop Reservoir Analogs, Pennsylvanian Mingus Formation, Mineral Wells, Texas.** Sat., 14 March, departing the University of Texas at Dallas. Janok Bhattacharya, University of Houston; Russell Davies, RDR

Inc.; Karen McGowen, ConocoPhillips. Cost: US\$100; students, US\$50. Min.: 15; max.: 45.

- Sedimentary Environments and Dinosaur Tracks, Woodbine Formation, Lake Grapevine (Dallas).** Sun., 15 March. John Holbrook, University of Texas at Arlington (UTA); Derek Main, UTA. Cost: US\$60; students and K–12 teachers, US\$30. Min.: 15; max.: 45.

### Post-meeting

- Field Work and Cyber-Mapping in the Arbuckle Mountains, Oklahoma.** Wed., 18 March. Mohammed Abdelsalam, Missouri University of Science and Technology (MUST); Carlos Aiken, University of Texas at Dallas; John Hogan, MUST. Cost: US\$100; students, US\$50. Min.: 15; max.: 30.

## SPECIAL EVENTS

**Icebreaker Reception:** Sun., 15 March, 5:30–7:30 p.m., UTD Conference Center.

**South-Central Section Management Board Meeting:** Mon., 16 March, 4:30–5:30 p.m., UTD Conference Center.

**South-Central Section Business Meeting:** Mon., 16 March, 5:30–6:30 p.m., UTD Conference Center.

**Reception for GSA 50-Year Members:** Mon., 16 March. Save the date—invitations will be sent! For more information, contact Jack Sharp, jmsharp@mail.utexas.edu, or Robert Rutford, rutford@utdallas.edu.

## TRAVEL GRANTS

Travel grants are available from the South-Central Section in cooperation with the GSA Foundation for GSA Student Members making oral or poster presentations at the meeting. Information and applications are at [www.geosociety.org/sectdiv/south/](http://www.geosociety.org/sectdiv/south/).

## OUTSTANDING POSTER PROGRAM

One undergraduate and one graduate student poster will be selected for recognition. Awardees will be given a complimentary registration to the 2009 GSA Annual Meeting & Exposition, and the selected posters will be displayed at that meeting.

## STUDENT VOLUNTEERS

We rely on student volunteers to help meetings run smoothly, and the local committee and officers of GSA's South-Central Section are pleased to offer student volunteers free registration for the meeting in return for ~6 hours of work. The deadline for volunteering is **1 February 2009**. Contact student volunteer coordinator John Holbrook at the University of Texas at Arlington, holbrook@uta.edu, if interested.

## OPPORTUNITIES FOR K–12 EDUCATORS

Please note the reduced rate for K–12 educators for the Sunday pre-meeting field trip “Sedimentary Environments and Dinosaur Tracks, Woodbine Formation, Lake Grapevine (Dallas).”

## Continuing Education Credit (CEU)

CEUs can be accrued from participation in organized education experiences. One CEU equals 10 contact hours and applies to meeting field trips and/or short courses. There's no extra charge for a certificate; please contact Beth Engle, bengle@geosociety.org, for more information.



# GSA Foundation Update

Donna L. Russell, Director of Operations

## EXTENDED: The Charitable IRA Rollover Act of 2006

One of the many provisions included in the Tax Extenders and Alternative Minimum Tax Relief Act of 2008 (passed by Congress on 3 October 2008) was the extension of the Charitable IRA Rollover Act of 2006. The bill makes no changes in the provisions of the IRA Rollover Act of 2006—it simply extends the 2006 provision of making charitable gifts from potentially taxable Individual Retirement Accounts (IRA) in 2008 and 2009 to qualified charities like the GSA Foundation. In short, gifts up to US\$100,000 to the GSA Foundation from your IRA may be deducted from income that could otherwise be subject to tax under federal law and the laws of many states.

as your required minimum distribution. Your IRA custodian will have the appropriate form for this withdrawal. To learn more about making an IRA rollover gift, check with your estate planner or contact the GSA Foundation office at +1-303-357-1054, drussell@geosociety.org.

### Don't Be Late!

All donations to the GSA Foundation must be postmarked by 31 December 2008 in order to be tax deductible for 2008. You can also donate via the Foundation's Web site at [gsafweb.org](http://gsafweb.org).

### Key Requirements

- The donor must be 70½ years of age or older at the time the gift is made.
- Rollover gifts cannot exceed US\$100,000 per taxpayer per year.
- Gifts must be made directly to the GSA Foundation (i.e., not to a donor advised fund or through a private foundation).

*This really is a new window of opportunity for GSA senior members.* While rollover gifts are not tax deductible, the amount rolled over from your IRA is also not included in your taxable income. If you have been concerned about paying taxes on money taken out of your IRA, **this rollover provides the means to send that money to the GSA Foundation intact**, not reduced by income taxes.

You still have time to make an IRA rollover gift in 2008, and you are not limited by the amount you may have already taken



### Most memorable early geologic experience:

As a preschooler, going with my grandfather to the Ohio State Museum in Columbus (he was a volunteer curator), and the excitement over being shown bright shiny minerals, strange bugs and shells, and so many rocks! I was hooked at 5 years of age!

—John T. Dutro

## Support GSA Programs

### Donate now!



cut out or copy

1 Enclosed is my contribution in the amount of \$ \_\_\_\_\_

2 Please credit my contribution to the:

Greatest Need

Other: \_\_\_\_\_ Fund

I have named GSA Foundation in my Will (please contact me)

3 Name \_\_\_\_\_

Address \_\_\_\_\_

City / State / Zip \_\_\_\_\_

Phone \_\_\_\_\_



4 Mail to:

GSA Foundation

P.O. Box 9140

Boulder, CO 80301

Or donate online at [www.gsafweb.org](http://www.gsafweb.org)

# In Memoriam

**Donald L. Baars**

Lawrence, Kansas, USA  
7 July 2008

**Alfonso M. Escalante**

Brandon, Mississippi, USA  
7 January 2008

**Robert Edward Folinsbee**

Nanticoke, Ontario, Canada  
notified 28 May 2008

**McLain J. Forman**

New Orleans, Louisiana, USA  
1 June 2008

**Irving Friedman**

Denver, Colorado, USA  
28 June 2008

**James N. Gundersen**

Las Cruces, New Mexico, USA  
1 April 2008

**John F. Harsh**

Tampa, Florida, USA  
7 January 2007  
(notified 2 Oct. 2008)

**Joseph H. Hartshorn**

Sarasota, Florida, USA  
5 May 2008

**Roy M. Huffington**

Houston, Texas, USA  
notified 14 July 2008

**Albert L. Kidwell**

Phoenix, Arizona, USA  
16 August 2008

**Charles E. Kirschner**

Union, Washington, USA  
7 November 2007  
(notified 22 Sept. 2008)

**Philip E. LaMoreaux**

Tuscaloosa, Alabama, USA  
23 June 2008

**Alvin R. Leonard**

Portland, Oregon, USA  
7 February 2007  
(notified 4 June 2008)

**Benjamin F. Leonard**

McCall, Idaho, USA  
5 September 2008

**Donald H. MacDonald**

Niagara on the Lake, Ontario,  
Canada  
2 November 2007  
(notified 30 June 2008)

**Muriel Mathez**

Columbia, New Jersey, USA  
1 June 2008

**Fred F. Meissner**

Centennial, Colorado, USA  
18 September 2007  
(notified 29 May 2008)

**Akiho Miyashiro**

Albany, New York, USA  
22 July 2008

**Alan E.M. Nairn**

Columbia, South Carolina,  
USA  
notified 23 July 2008

**Margaret O. Oros**

New Rockford, North Dakota,  
USA  
notified 10 June 2008

**John S. Owens**

Pengilly, Minnesota, USA  
30 June 2008

**Robert T. Russell**

Montrose, Colorado, USA  
21 May 2008

**Amos Salvador**

Austin, Texas, USA  
2 December 2007  
(notified 2 Oct. 2008)

**John S. Shelton**

La Jolla, California, USA  
24 July 2008

**Raymond T. Stotler Jr.**

Dallas, Texas, USA  
11 June 2008

**Sidney E. White**

Columbus, Ohio, USA  
7 September 2008



To honor a friend or colleague with a GSA Memorial, please go to [www.geosociety.org/pubs/memorials/mmlGuid.htm](http://www.geosociety.org/pubs/memorials/mmlGuid.htm) to learn how. Contact the GSA Foundation at +1-303-357-1054, [drussell@geosociety.org](mailto:drussell@geosociety.org), [www.gsafweb.org](http://www.gsafweb.org), if you would like to contribute to the Memorial Fund.

# About People

In recognition of his extraordinary originality, creativity, dedication, and "promise for important future advances," GSA Fellow **David Montgomery** has been awarded a MacArthur Fellowship by The John D. and Catherine T. MacArthur Foundation. Read more at [www.macfound.org](http://www.macfound.org).

GSA Senior Fellow **Farouk El-Baz** met with U.S. President George W. Bush at the White House for an Iftar reception and dinner in recognition and celebration of Ramadan on 17 September 2008. El-Baz is director of the Boston University Center for Remote Sensing.

At the 33rd International Geological Congress (IGC) in Oslo, Norway, 5–14 August, GSA Member **Stan Finney** began a four-year term as chair of the International Commission on Stratigraphy (IUGS). Also during the IGC, GSA Fellow **Carlton Brett** was presented with the IUGS Digby McLaren Prize in recognition of his outstanding career of significant contributions toward advancing the discipline of stratigraphy.

In July 2008, GSA Fellow **Gordon Lister** was awarded the S.W. Carey Medal by the Geological Society of Australia for a distinguished career in the field of tectonics.

GSA Member **Robert Detrick** of the Woods Hole Oceanographic Institution has been named the director of the Division of Earth Sciences for the National Science Foundation Directorate for Geosciences.

Deceased GSA Fellow **Fred F. Meissner** (see *In Memoriam*), a petroleum geologist with the Colorado School of Mines, was posthumously awarded the American Association of Petroleum Geologists (AAPG) Sidney Powers Memorial Award in April 2008. This gold medal, given in recognition of distinguished and outstanding contributions to, or achievements in, petroleum geology, is AAPG's highest honor.

 THE GEOLOGICAL SOCIETY  
OF AMERICA®



## Recent, Rare, And Out-Of-Print Books

geoscience, paleontology, mineralogy, mining history,  
ore deposits, USGS publications, petroleum,  
remote sensing, and metallurgy

<http://booksgeology.com>

[msbooks@booksgeology.com](mailto:msbooks@booksgeology.com)

**WE PURCHASE BOOKS AND ENTIRE COLLECTIONS**

MS Book and Mineral Company  
P.O. Box 6774, Lake Charles, LA 70606-6774 USA.



# LIFE OF THE PAST



## A SEA WITHOUT FISH

*Life in the Ordovician Sea of the Cincinnati Region*

**David L. Meyer and Richard Arnold Davis • With a chapter by Steven M. Holland**

A thorough introduction to the abundant and beautiful rocks, fossils, and ancient sea-dwelling animals of the Cincinnati, Ohio region found in limestones and shales deposited on the sea floor about 450 million years ago.

Cloth \$44.95



## VERTEBRATE MICROFOSSIL ASSEMBLAGES

*Their Role in Paleocology and Paleobiogeography*

**Edited by Julia T. Sankey and Sven Baszio**

The minute remains of animals and plants have proven very useful to paleontologists as tools for dating large fossils, describing the environments which existed at the time the fossils were deposited and identifying and mapping the extent of local floras and faunas, among other things. This volume presents state-of-the-art papers on important topics and methods in the analysis of vertebrate microfossil assemblages.

Cloth \$59.95



## ECHINODERM PALEOBIOLOGY

**Edited by William I. Ausich and Gary D. Webster**

Treats various paleobiological approaches to the phylum's remarkable evolutionary history.

"Timely and necessary . . . the echinoderm fossil record provides the ideal data with which to ask important paleobiologic and evolutionary questions and to expect high-resolution answers."

—Roy Plotnick, University of Illinois, Chicago Circle

Cloth \$59.95



INDIANA UNIVERSITY PRESS

INDIANA UNIVERSITY

800-842-6796 • [iupress.indiana.edu](http://iupress.indiana.edu)



## We Know The Drill

Sonic  
Direct Push  
Hollow Stem Auger  
Air Rotary Casing Hammer  
Air Rotary  
Mud Rotary  
STRATEX® / ODEX®  
Large Diameter Flooded Reverse Circulation  
Dual Tube Reverse Circulation  
Wireline Coring  
Well Development & Abandonment  
Vac Truck / Air Knife

[wdcexploration.com](http://wdcexploration.com)



Albuquerque Elko Las Vegas Los Angeles Minneapolis Phoenix Sacramento San Francisco

## Positions Open

### TENURE-TRACK POSITION SCHOOL OF GEOGRAPHY AND EARTH SCIENCES MCMASTER UNIVERSITY

The School of Geography and Earth Sciences at McMaster University ([www.science.mcmaster.ca/geo](http://www.science.mcmaster.ca/geo)) invites applications for a tenure track position in Stable Isotope Geochemistry at the Assistant Professor level beginning 1 July 2009. Appointment at the Associate Professor level may be considered under exceptional circumstances.

The School seeks an innovative earth scientist with an outstanding research record in the application of isotopes to understand processes in the environmental context, or the development of new and innovative isotopic techniques for the investigation of the geosphere. Candidates with research complementary to existing faculty research are strongly encouraged.

The successful applicant must hold a Ph.D. degree in Geology, Earth Sciences, Geochemistry, or a closely related field. The candidate will be expected to develop a strong externally funded research program and should have a strong commitment to undergraduate/graduate teaching and supervision.

All qualified candidates are encouraged to apply; however Canadians and permanent residents will be considered first for this position. McMaster University is strongly committed to employment equity within its community, and to recruiting a diverse faculty and staff. The University encourages applications from all qualified candidates, including women, members of visible minorities, Aboriginal persons, members of sexual minorities, and persons with disabilities.

The evaluation of candidates will begin on 15 January 2009 and will continue until the position is filled.

Applicants should send a cover letter outlining their research interests, a copy of their curriculum vitae, a statement of teaching philosophy (max. 2 pp.) and evidence of teaching effectiveness (if any), contact information for three referees (address, phone number and e-mail) and copies of no more than three reprints or works in progress to the Chair of the search committee. Electronic applications will NOT be accepted.

Dr. Bruce Newbold, Chair, Search Committee, School of Geography and Earth Sciences, General Science Building, Room 206, McMaster University, 1280 Main Street West, Hamilton, ON L8S 4K1, Tel: +905-525-9140, ext. 27948, Fax: +905-546-0463, e-mail: [newbold@mcmaster.ca](mailto:newbold@mcmaster.ca).

### ASSISTANT PROFESSOR, SOIL SCIENCE OR LOW-TEMPERATURE AQUEOUS GEOCHEMISTRY UNIVERSITY OF TENNESSEE AT CHATTANOOGA

The Dept. of Physics, Geology, and Astronomy at The University of Tennessee at Chattanooga invites applicants for a tenure-track appointment at the rank of Assistant Professor to begin in August 2009. We seek a soil scientist or a low-temperature aqueous geochemist who is committed to undergraduate teaching and research. Additional strengths in the areas of clay mineralogy and/or physical hydrology are also desired. The successful candidate must have a Ph.D. in geology or related field by the time of appointment and should demonstrate familiarity with modern research and geotechnical tools and techniques. Teaching responsibilities will include introductory courses in geology, upper-level courses in areas of expertise, and supervision of undergraduate research.

Applicants should send a letter of application describing their qualifications, statements of teaching philosophy and research interests, a current curriculum vitae, official transcripts, and three letters of recommendation to Dr. Habte G. Churnet, Head, Dept. of Physics, Geology and Astronomy, MC 6556, 615 McCallie Avenue, The University of Tennessee at Chattanooga, Chattanooga, TN 37403. Review of application materials will begin 15 January 2009 and will continue until the position is filled. The University of Tennessee at Chattanooga is an equal employment opportunity/affirmative action/Title VI & IX/Section 504/ADA/ADEA institution.

### GEOGRAPHY, GEOLOGY, AND THE ENVIRONMENT SLIPPERY ROCK UNIVERSITY, PENNSYLVANIA

Slippery Rock University of Pennsylvania is seeking applicants for two (2) full time, tenure track positions at the Assistant Professor level in the Dept. of Geography, Geology, and the Environment, beginning in August 2009.

For both positions, a Ph.D. in Geography, Geology, or a related field at time of appointment is required. Successful performance in an on-campus interview, including teaching and research demonstrations, is also required. The candidates must demonstrate a commitment to the education of diverse populations.



## PROFESSOR/ENDOWED CHAIR (Four positions) Department of Geology & Geophysics

The Department of Geology & Geophysics at LSU announces a multiple year search to fill four endowed chair positions. For each position we seek an outstanding individual with an internationally recognized scientific reputation who will develop a strong, externally-funded research program. We invite inquiries, nominations, and applications for:

**BILLY AND ANN HARRISON ENDOWED CHAIR:** We seek an individual who will assume a leadership role among a large group of interdisciplinary scientists at LSU studying the dynamics of sedimentation, sedimentary environments, and sedimentary rocks. Research in fluvial, deltaic, and coastal processes has been elevated to one of three university-wide focus areas, with significant participation expected from the departments of Geology & Geophysics, Geography & Anthropology, Oceanography, and Civil & Environmental Engineering.

**JOHN FRANKS ENDOWED CHAIR IN THE DEPARTMENT OF GEOLOGY AND GEOPHYSICS:** We seek an individual with research interests in the broadly defined field of Earth materials and solid Earth processes. Potential areas of research include, but are not limited to, mineralogy, petrology, geochemistry, geophysics, and tectonics. Two interdisciplinary research clusters at LSU, in materials science and high performance computing, offer immediate opportunities to establish links with other high-level programs on campus.

**CHARLES T. MCCORD, JR., ENDOWED CHAIR OF GEOLOGY:** We seek an individual who will: 1) develop a program centered on fundamental and applied research relevant to petroleum geology, 2) complement existing departmental expertise in sedimentary geology and geophysics, 3) strengthen interdisciplinary teaching and research with LSU's department of Petroleum Engineering, and 4) maintain LSU's strong ties with the petroleum industry. Candidates with significant petroleum industry experience are encouraged to apply.

**AASP CHAIR IN PALEOPALYNOLOGY:** We seek an individual that will develop a program in stratigraphic paleopalynology, particularly chronostratigraphy and/or paleoecology. The successful candidate will serve as Director of the American Association of Stratigraphic Palynologists (AASP) Center for Excellence in Palynology within the Department of Geology & Geophysics. Candidates with significant academic and/or petroleum industry experience, along with administrative leadership skills commensurate with building and directing a research center are encouraged to apply.

**Required Qualifications:** Ph.D. in geological sciences or other relevant disciplines; a strong record of published research; demonstrated ability to attract funding. **Responsibilities:** supervises graduate student research; publishes in highly ranked journals; teaches undergraduate and graduate courses in his or her area of specialization. Chair appointments would normally be made at the rank of Full Professor. However, exceptional candidates at the Associate Professor level will be considered.

The Department of Geology and Geophysics consists of 15 tenured and tenure-track faculty members having a wide range of expertise and offers B.S., M.S., and Ph.D. degrees in geology. The Department has a strong record in research and graduate training, ongoing federal and industry funded research and teaching programs, and a large and active alumni base. Two interrelated focus areas: "Evolution of Sedimentary Systems" and "Earth Materials and Solid Earth Processes" have been developed within the LSU Department of Geology and Geophysics to enhance existing strengths of the Department and allow the Department to interface synergistically with other academic units at LSU. See [www.geol.lsu.edu](http://www.geol.lsu.edu) for more information regarding these focus areas, faculty, facilities, and research programs.

An offer of employment is contingent on a satisfactory pre-employment background check. Application deadline is **January 2, 2009** or until candidates are selected. Nominations or inquiries should be directed to Endowed Chair Search Committee, at **225-578-3353** or **geology@lsu.edu**. Applicants should send a copy of their curriculum vitae (including e-mail address), a statement of their research and teaching interests, and the names, addresses, phone numbers, and e-mail addresses of at least three references to: **Endowed Chair Search Committee, Department of Geology and Geophysics, Louisiana State University, Ref: Log #2013, Baton Rouge, LA 70803.**

*LSU IS AN EQUAL OPPORTUNITY/EQUAL ACCESS EMPLOYER*

The selected candidates will be responsible for teaching introductory level Geography courses, as well as upper division courses in her/his area of expertise. The department has a tradition of providing students with opportunities for research, field experiences, and travel; the successful candidate will be expected to contribute to these efforts. We encourage applicants across a broad range of research interests, regional specialties, theoretical frameworks, and methodological approaches.

**Position One (#09-38):** We seek a broadly trained Human Geographer with an active research and publication agenda, who can support the Department's environmental programs in a liberal arts context. Applicants must be prepared to teach cultural geography. Preference will be given to candidates who also demonstrate the ability to teach GIS at the introductory level.

**Position Two (#09-39):** We seek an environmental geographer/geoscientist, with an active research and publication agenda, and whose expertise is compatible with the Department's environmental programs. Applicants must be prepared to teach GIS, from introductory through advanced levels. Preference will be given to candidates who also demonstrate the ability to enhance departmental strengths in surficial Earth Systems—atmosphere, biosphere, hydrosphere, and lithosphere.

**Indicate the single position for which you wish to be considered.** Send letter of interest, statements of your teaching philosophy and research agenda, curriculum vita, graduate and undergraduate transcripts (official transcripts are required before hiring), and letters from three references (include a list of their names, addresses

and phone numbers) to: Search Committee Chair, Dept. of Geography, Geology, and Environment, 319 Advanced Technology and Science Hall, Slippery Rock University, Slippery Rock, PA 16057, e-mail: [jialing.wang@sru.edu](mailto:jialing.wang@sru.edu) for position one (09-38), e-mail: [patrick.burkhart@sru.edu](mailto:patrick.burkhart@sru.edu) for position two (09-39), Fax: +1-724-738-4217.

Review of complete application materials will begin on 5 January 2009, continuing until the positions are filled. Background investigation required for employment. Slippery Rock University of Pennsylvania is a member of the State System of Higher Education and is an affirmative action/equal opportunity employer. Visit our Web page at [www.sru.edu](http://www.sru.edu). TTY# +1-724-738-4881. Further information about the department is available at <http://academics.sru.edu/gge/index.html>.

#### TENURE-TRACK FACULTY POSITION IN MINERALOGY/PETROLOGY NORTHERN ILLINOIS UNIVERSITY

The Dept. of Geology and Environmental Geosciences at Northern Illinois University invites applications for an anticipated tenure-track position at the Assistant Professor level to begin in August, 2009. We seek an individual whose research interests are in the broad areas of mineralogy, petrology, or a closely allied field. We expect the successful applicant to establish a vigorous externally funded research program that integrates with one or more of our existing strengths in experimental mineralogy/petrology, geochemistry, igneous petrology, mineral physics, planetary geology, structural geology, and/or volcanology. He/she will also be expected to supervise Ph.D. and M.S. students and have a commitment to excellence in teaching at both the undergraduate and graduate levels. The department's facilities include an array of analytical instruments (e.g. electron microprobe, X-ray diffractometer, ion chromatograph, mass spectrometers) and field equipment. Further, NIU is part of the CARS research consortium at the nearby Advanced Photon Source of Argonne National Laboratory. Applicants who can utilize or expand existing facilities will receive special consideration. A Ph.D. in the geosciences or a related field is required at the time of appointment. The department offers programs leading to the B.S., M.S., and Ph.D. degrees, and currently has 13 faculty members, whose research and teaching interests are described on our Web site at [www.niu.edu/geology/](http://www.niu.edu/geology/). Applicants must submit a letter of application, curriculum vitae, statements of teaching and research interests, and list of at least three references to: James Walker, Search Committee Chair, Dept. of Geology and Environmental Geosciences, Northern Illinois University, DeKalb, IL 60115. Complete applications must be received by 12 January 2009. AA/EEO Institution.

#### ASSISTANT PROFESSOR, GEOLOGY PHYSICAL SCIENCE DEPARTMENT WESTFIELD STATE COLLEGE

Westfield State College invites applications for a full time, tenure-track Assistant Professor to teach 12 hours per semester, potentially including courses in physical geology, historical geology, and geologic hazards, and will develop additional introductory-level courses (such as oceanography, or planetary geology, or earth systems). An occasional upper-level course that integrates the other physical sciences with a geological topic may also be available. Contributions to the college community, advising of students, and some continuing scholarship are also expected.

A Ph.D. in any area of geology is required, as are excellent communication and interpersonal skills and a strong commitment to teaching at the introductory undergraduate level. Some preference will be given to candidates who have previous teaching experience at the undergraduate level and/or who are able to teach occasional courses in other departmental areas, including astronomy, chemistry, or physics.

Review of applications will begin on 20 January 2009 and will continue until the position is filled.

AN ONLINE APPLICATION IS REQUIRED: Visit <http://jobs.wsc.ma.edu/applicants/Central?quickFind=51185> for a detailed job description, minimum qualifications, and to submit an online application, attach required documents and view mailing address for reference materials. For further assistance, call +1-413-572-8158.

Westfield State College, founded in 1838, began as the nation's first public coeducational school for teacher preparation. It has since evolved into a selective public institution, offering undergraduate and master's level graduate programs to over 5,000 students. The most residential of the nine Massachusetts state colleges, Westfield State takes pride in its warm atmosphere, small class sizes, and attractive campus. Westfield State College is located in western Massachusetts considered the entranceway of the Berkshires approximately two

hours from Boston, Providence and Albany and about three hours from New York City.

The college strongly encourages applications from women, minorities, and individuals with disabilities. An Affirmative Action/Equal Opportunity Employer.

#### SEDIMENTARY GEOLOGY, UNIVERSITY OF IOWA

The Dept. of Geoscience at the University of Iowa invites applications for a full-time tenure-track position in Sedimentary Geology at the Assistant Professor level. The appointment will begin in August 2009. We seek an outstanding researcher and teacher whose approach is quantitative, integrative, and preferably field-based. Areas of interest might include but are not limited to: sequence stratigraphy, basin analysis, quantitative stratigraphy, clastic or carbonate sedimentology, petroleum geology, and depositional environments.

The department and the College of Liberal Arts and Sciences are strongly committed to gender and ethnic diversity; the strategic plans of the University, College, and Department reflect this commitment.

Emphasis will be placed on the applicant's potential to establish a successful, externally funded research program that complements existing strengths within the department (including climate change, geochemistry, paleontology, structural geology, tectonics, and natural resources) as well as interdisciplinary initiatives across the University. In addition to attracting and mentoring high quality graduate students, the successful candidate will be expected to teach at the undergraduate and graduate levels, including teaching a large general-education lecture course for the interdisciplinary Environmental Sciences BS program. Applicants should have a Ph.D. in hand by August 2009.

Women and members of underrepresented minorities are especially encouraged to apply. The University of Iowa is an affirmative action / equal opportunity employer.

Only online applications will be considered. Applicants should apply online at <http://jobs.uiowa.edu> (requisition number: 56283). Attachments to the application should include cover letter, curriculum vitae, and contact information for three letters of recommendation. Screening of applications begins 9 January 2009 and will continue until the position is filled.

#### PRECEPTOR, EARTH AND PLANETARY SCIENCES (TEACHING/CURRICULUM DEVELOPMENT) HARVARD UNIVERSITY

The Dept. of Earth and Planetary Sciences seeks applications for a preceptor. The successful applicant should be well versed on the issues of earth sciences, and have experience in developing and supporting sections and labs. A strong doctoral record is preferred. The salary range for this position is US\$47,900 to US\$53,100 depending on qualifications and experience. The position is renewable on a yearly basis for up to eight years. For greater detail about this position and to apply, visit the EPS Web site at [www.eps.harvard.edu/jobs.php](http://www.eps.harvard.edu/jobs.php). Applications should include: (1) a cover letter that discusses how this position would fit into the applicant's career trajectory; (2) the names and addresses of three referees; (3) a CV; and (4) a statement of teaching experiences and philosophy. The three letters of recommendation should be submitted separately and at least one letter must discuss the applicant's experience with teaching, administration skills, and other educational work.

Harvard is an Equal Opportunity/Affirmative Action employer. Applications from women and minorities are strongly encouraged.

#### ASSISTANT/ASSOCIATE PROFESSOR IN GEOLOGY UNIVERSITY OF TEXAS-PAN AMERICAN

The Dept. of Physics and Geology at the University of Texas-Pan American invites applications for a tenure track assistant/associate professor position in geology [F08/09-47] beginning in the fall of 2009. The successful candidate will be expected to teach undergraduate lectures and lab courses in geology. The University of Texas-Pan American is a dynamic medium-size university with a primarily Hispanic student population of approximately 18,000 students located in the lower Rio Grande Valley of Texas, a sub-tropical area that is one of the fastest growing regions of the US.

Please note the following criteria apply for each professorial rank and specify in your letter of application the rank you are applying for.

Required qualification for Assistant Professor: Earned Doctorate in Geological/Earth Sciences, in hand at the time of appointment, and a demonstrated commitment to undergraduate education/research. Evidence of excellence in teaching, a demonstrated record of achievement in research, and a commitment to departmental and public service. The ability to communicate effectively with faculty and students is essential.

Required qualification for Associate Professor: Earned Doctorate in Geological/Earth Sciences. Proven excellence in teaching, a strong record of achievement in research, and a commitment to departmental and public service. A strong record of achievement in research includes significant publications within the discipline, previous success in developing a research program, and attracting external funding. The ability to communicate effectively with faculty and students is essential.

Desired Qualification for Both Ranks: College-level teaching experience is preferred, as is a broad background in Geology, Geophysics and/or GIS/Remote Sensing. The integration of GIS/Remote Sensing into undergraduate coursework and research is an asset, and assisting with Geology Field trips to Mexico and North Texas is expected. This position would be of special interest to candidates looking to establish a research program and grow with a newly revitalized and rapidly expanding department.

Current Degrees Offered: B.S. in Physics, MSIS in Physics Education, Minors in Physics, Physical Science, GIS and Earth Science.

To apply for position, send

- application form ([www.utpa.edu/humanresources/employment/faculty.html](http://www.utpa.edu/humanresources/employment/faculty.html));
- cover letter indicating (1) position (2) position number, and (3) rank applying for;
- CV;
- contact information of three references;
- transcripts;
- statement of research plan; and
- teaching philosophy.

to Geology Search Committee, Dean's Office, College of Science and Engineering, University of Texas-Pan American, 1201 W University Drive, Edinburg, TX 78541-2999.

Further information links:

- The Department: <http://www.utpa.edu/dept/physci/>.
- UTPA: <http://www.utpa.edu/>.

Closing Date: The position will remain open until filled; however, for best consideration, application materials must be received by 15 January 2009.

NOTE: UTPA is an affirmative action/Equal Opportunity Employer. Women, racial/ethnic minorities and individuals with disabilities are encouraged to apply. This position is security sensitive as defined by the Texas Education Code §51.215(C) and Texas Government Code §411.094(a)(2). Federal Law requires compliance with the Immigration Reform Control Act of 1986. Texas law requires faculty members whose primary language is not English to demonstrate proficiency in English as determined by a satisfactory grade on the International Test of English as a Foreign Language (TOEFL).

#### TENURE-TRACK POSITION EARTH AND MINERAL SCIENCE PENN STATE-BEAVER

Penn State-Beaver invites applications for the position of Assistant Professor of Earth and Mineral Science (tenure track, 36 weeks) to begin August 2009, or as negotiated. Teach multidisciplinary undergraduate courses for non-majors in the physical earth sciences. Courses might include physical geology and geography, environmental studies, physical oceanography, and principles of local, regional and global land forming processes, along with a wide variety of courses in related disciplines. All courses will encompass classroom, laboratory, field, library, and computer components in addition to using traditional and hybrid delivery modes. Publish in refereed journals and participate in campus, university, professional, and community service activities. Ph.D. in one of the physical earth science fields (geography, geology, and environment). To learn more about the campus and Penn State, visit [www.psu.edu/ur/cmpcoll.html](http://www.psu.edu/ur/cmpcoll.html). To learn more about the position and how to apply, visit [www.psu.edu/jobs/Opportunities/Opportunities.html](http://www.psu.edu/jobs/Oppportunities/Opportunities.html) and follow the "Faculty" link. AA/EOE.

#### GEOLOGY LABORATORY SUPERVISOR WASHINGTON AND LEE UNIVERSITY

The Washington and Lee Geology Department invites applications for a full-time, permanent supervisor of our analytical laboratories. The new Laboratory Supervisor will primarily maintain, oversee, and facilitate the use of our analytical laboratories and field equipment in service of both our teaching and research missions. Additional responsibilities will include assisting the development and implementation of laboratory assignments in Geology classes, design of sampling/analytical methods, data quality assurance, upkeep of the samples and equipment in the teaching laboratories, teaching assistance, and other department tasks as needed. We seek an earth scientist with a master's degree who is organized, self-motivated and skilled in the use of modern analytical equipment and proce-



dures for the collection of geological data. Additional experience with field equipment, GIS, and computing is preferred. A Washington and Lee University Application for Employment, cover letter describing experience with analytical instrumentation, computers, field equipment, etc., and a résumé are required. To apply visit the Human Resources Web site at [go.wlu.edu/jobs](http://go.wlu.edu/jobs). Review of applications will begin 15 January. Washington and Lee is a highly selective, private liberal arts college in western Virginia. Our location in the central Appalachians facilitates a strong field curriculum to which we seek to add strength in laboratory activities. The department has excellent analytical (SEM-EDS, XRD, ICP-OES, IC), field (seismometer, gravimeter, resistivity, GPS, hydrologic) and computing (GIS, Remote Sensing, 2-D/3-D geophysical packages) equipment. More information can be found at [geology.wlu.edu](http://geology.wlu.edu). Washington and Lee is an Equal Opportunity Employer. Women and minorities are encouraged to apply.

#### COASTAL PROCESSES UNIVERSITY OF CALIFORNIA-SANTA BARBARA

The Dept. of Earth Science at the University of California-Santa Barbara seeks a geoscientist who conducts creative research in coastal processes, broadly defined, and could include sediment transport/deposition, source to sink dynamics, geochemical/biogeochemical cycling, sedimentary petrology, sedimentation, coastal energy resources and impacts of sea level change. A field orientation combined with expertise in analytical and/or computational tools is preferred. The appointee is expected to develop a vigorous, externally funded research program and teach both undergraduate and graduate courses. This tenure-track appointment will be at the rank of Assistant Professor to begin 1 July 2009 or later.

A Ph.D. is required at the time of appointment. Review of applications will begin 8 December 2008, and will remain open until filled. Applicants should submit a PDF file containing a letter of application, curriculum vita, a description of teaching and research objectives and accomplishments, and contact information for three referees. The application file should be submitted via e-mail to [CoastalProcesses@geol.ucsb.edu](mailto:CoastalProcesses@geol.ucsb.edu). Queries about this position can be directed to Edward Keller ([keller@geol.ucsb.edu](mailto:keller@geol.ucsb.edu)).

The department is especially interested in candidates who can contribute to the diversity and excellence of the academic community through research, teaching, and service. For more information about the department, visit our Webpage ([www.geol.ucsb.edu](http://www.geol.ucsb.edu)). UCSB is an Equal Opportunity/Affirmative Action employer.

#### DIRECTOR, NEVADA SEISMOLOGICAL LABORATORY AND PROFESSOR OF GEOPHYSICS UNIVERSITY OF NEVADA-RENO

The University of Nevada-Reno (UNR) invites applications for the position of Director, Nevada Seismological Laboratory (NSL), and Professor of Geophysics in the Dept. of Geological Sciences and Engineering (DGSE). The Director of NSL reports directly to the Director of the Mackay School of Earth Sciences and Engineering within the College of Science, and will have the vision and initiative to enhance an already thriving environment of teaching and innovative research in seismology and geophysics, in areas including the physics of earthquake processes, earthquake hazards, regional tectonics, paleo-earthquake studies, theoretical and applied geophysics, engineering seismology, computational seismology, geodesy, and seismic network applications.

By leading a diversely talented group of professional researchers, technical and support staff, postdoctoral fellows, and graduate students, the NSL Director will have considerable leverage to realize the potential of NSL's mission of reducing earthquake risk, fundamental seismological research, regional earthquake monitoring, and statewide public service. As Professor of Geophysics, the successful candidate will find innovative ways to integrate lessons from leading edge research into the graduate and undergraduate curriculum, and to create new opportunities for research, aimed at making UNR the venue of choice in seismology and geophysics for future students, faculty, and staff. Effectively engaging the media and the public in raising awareness and understanding of earthquake risks and hazards will place the Director in the position to affect state, regional, and national public policy.

The NSL plays a dual role as a statewide agency and a UNR department, with 19 academic, administrative and classified staff, as well as student and part-time employees, supporting contracts totaling >\$10M in current grants, with typically ~\$3M/yr in grant-supported research. As manager of the NSL, the Director will successfully oversee grants, contracts and the manage-

## Alberta Geological Survey

[www.ags.gov.ab.ca](http://www.ags.gov.ab.ca)

### Surficial Geologists Career Opportunities

Alberta Geological Survey (AGS) provides geoscience information and expertise to government, industry and the public to support exploration, development, conservation and regulation of Alberta's energy, mineral and groundwater resources. Within the AGS Mapping Section, two additional geologists are needed to map and interpret the surficial geology of Alberta.

#### Senior Surficial Geologist Surficial Geologist

At AGS, you will have the opportunity to work in a stimulating environment on challenging field and office-based projects, work with advanced technology, and remain current in your field while making significant contributions to your community of practice.

### Join us and enjoy the Alberta advantage!

Please visit [www.ags.gov.ab.ca/employment.html](http://www.ags.gov.ab.ca/employment.html) for full job descriptions and for qualification and application details.



ment of personnel for a diverse portfolio of projects. The NSL is one of the primary regional network operators of the USGS Advanced National Seismic System and is the statewide agency designated to provide earthquake information to the public and to first-responders. The NSL operates a regional network of over 200 real-time seismograph stations that spans Nevada and areas of eastern California, and operates its own statewide data communications system. Moreover, the NSL conducts seismic hazard research and operates the seismic monitoring program for the Dept. of Energy's Yucca Mountain Project.

Applications: Tenure will be awarded upon appointment, subject to approval by the Board of Regents. Therefore, candidates must qualify as Professor of Geophysics, and so must have a Ph.D. in seismology, geophysics, or a related field, with a strong publication

record in peer-reviewed journals, a successful record of leadership and management of innovative research programs, and a history of securing competitive research grants in seismology or geophysics. NSL contracts have involved access to sensitive government facilities; therefore, U.S. Citizenship is required, and the candidate should be able to obtain a DOE clearance. Experience working in an academic setting is preferred. Since the NSL is a focal point of public interest following significant regional earthquakes, effective media skills and public presence are preferred.

For more information and to apply, visit [www.unresearch.com/applicants/Central?quickFind=53313](http://www.unresearch.com/applicants/Central?quickFind=53313). Screening of applications will begin on 1 February 2009. The preferred starting date of 1 July 2009 is flexible. EEO/AA women and underrepresented groups are encouraged to apply.

**ENVIRONMENTAL MINERALOGIST  
UNIVERSITY OF MIAMI-CORAL GABLES**

The University of Miami is committed to educating and nurturing students, creating knowledge, and providing service to our community and beyond. We are leaders in the area of education, scholarship, intercollegiate athletics and service. Come join our team!

The Dept. of Geological Sciences, College of Arts and Sciences invites applications for a tenure-track position at the assistant-professor level from persons in the field of environmental mineralogy and geochemistry including such disciplines as microbe-mineral interactions and bio-mineralization. The department is seeking a person to lead an active research program, to have demonstrated capacity for and interest in interdisciplinary or trans-disciplinary research, and to teach in the undergraduate program. Ph.D. required.

The successful applicant will be expected to teach undergraduate courses in earth materials, optical mineralogy, and low-temperature geochemistry, collaborate with other faculty, guide graduate and undergraduate research, advise students, and obtain extramural research funds.

Research interests of the current faculty range from coastal and shallow-marine sedimentation, to paleoclimatic studies using marine sediment records, hydrologic modeling, igneous petrology and geochemistry, carbonate and organic sediment processes and diagenesis, and geo-biology.

The Department works closely with the 15 faculty members of the Division of Marine Geology and Geophysics at the Rosenstiel School of Marine and Atmospheric Science on the Virginia Key campus and faculty in the Dept. of Geological Sciences have secondary appointments there.

Applicants should submit a letter summarizing their research and teaching interests, curriculum vitae, and the names of three references before 20 January 2009 to Dr. Harold R. Wanless, Chair, Dept. of Geological Sciences, University of Miami, Box 249176, Coral Gables, Florida, 33124-9176, or [geosearch@miami.edu](mailto:geosearch@miami.edu).

We expect to fill the position by 15 May 2009, with a start date of 15 August 2009.

The University of Miami offers competitive salaries and a comprehensive benefits package including medical and dental benefits, tuition remission, vacation, paid holidays and much more. The University of Miami is an Equal Opportunity/Affirmative Action Employer.

**SURFICIAL PROCESSES OR HYDROGEOLOGY  
UNIVERSITY OF MIAMI-CORAL GABLES**

The University of Miami is committed to educating and nurturing students, creating knowledge, and providing service to our community and beyond. We are leaders in the area of education, scholarship, intercollegiate athletics and service. Come join our team!

The Dept. of Geological Sciences, College of Arts and Sciences invites applications for a tenure-track position at the assistant-professor level from persons in the field of surficial geological processes and/or hydrogeology. We seek individuals with research interests in geological aspects of the physical, chemical and/or biological processes affecting terrestrial, wetland, coastal, and/or groundwater environments. Research focus may be in fluid-sediment dynamics, soils, or other physical, chemical or bio-chemical aspects of surficial processes or hydrogeology. The ideal candidate will also have interests in human impacts or large scale resource management and integrate some combination of remote sensing, field, laboratory and modeling in their research. The department is seeking a person to lead an active research program and to have demonstrated capacity for and interest in interdisciplinary or trans-disciplinary research. Ph.D. required.

The successful applicant will be expected to teach introductory and advanced undergraduate courses, collaborate with other faculty, supervise graduate and undergraduate research, and obtain extramural research funds.

Research interests of the current faculty range from coastal and shallow-marine sedimentation, to paleoclimatic studies using marine sediment records, hydrologic modeling, igneous petrology and geochemistry, carbonate and organic sediment processes and diagenesis, and geo-biology.

The Department works closely with the 15 faculty members of the Division of Marine Geology and Geophysics at the Rosenstiel School of Marine and Atmospheric Science on the Virginia Key campus and faculty in the Dept. of Geological Sciences have secondary appointments there.

Applicants should submit a letter summarizing their research and teaching interests, curriculum vitae, and the names of three references before 20 January 2009 to Dr. Harold R. Wanless, Chair, Dept. of Geological

Sciences, University of Miami, Box 249176, Coral Gables, Florida, 33124-9176, or [geosearch@miami.edu](mailto:geosearch@miami.edu).

We expect to fill the position by 15 May 2009, with a start date of 15 August 2009.

The University of Miami offers competitive salaries and a comprehensive benefits package including medical and dental benefits, tuition remission, vacation, paid holidays and much more. The University of Miami is an Equal Opportunity/Affirmative Action Employer.

**CHAIR  
DEPT. OF GEOGRAPHY AND EARTH SCIENCES  
UNIV. OF NORTH CAROLINA AT CHARLOTTE**

Effective 1 July 2009: 12-month appointment. Required qualifications: (1) a doctoral degree in a field relevant to the five thematic areas framing the department's research, teaching and outreach mission; (2) a distinguished record of scholarship and teaching, appropriate for appointment as a full professor; (3) demonstrated ability to provide transformational leadership for a productive and innovative department. Desired qualifications: prev. admin. experience, a record of securing external funding, AA/EOE. A full description of the position and application details can be found at <http://jobs.uncc.edu>. Screening of applications began 1 Nov. 2008. For more information, contact Dr. Brian Etherton at +1-704-687-5984, [betherto@uncc.edu](mailto:betherto@uncc.edu), Dr. Ross Meentemeyer at +1-704-687-5944, [rkmeente@uncc.edu](mailto:rkmeente@uncc.edu), or go to [www.geoeath.uncc.edu](http://www.geoeath.uncc.edu).

**ASSISTANT PROFESSOR—GEOPHYSICS  
HOFSTRA UNIVERSITY**

The Dept. of Geology, Hofstra University, invites applications for an anticipated tenure track position at the assistant professor level beginning September 2009. We seek a candidate with a background in Geophysics applied to one or more of the following areas: hydrology, petroleum exploration geology, or geodynamics. Candidates must be committed to excellence in undergraduate teaching and mentoring undergraduate students in research. The successful candidate will have a nine contact hour per semester teaching load and will be expected to teach one introductory level and one advanced undergraduate course per semester. The ideal candidate will teach physical geology and should be prepared to offer an advanced lecture/laboratory course in geophysics and an additional advanced course in topics of interest to the candidate that complement the existing course offerings in the department. We are looking for a dynamic individual who combines excellence in teaching with breadth and versatility in professional productivity, and who shares our commitment to close student-faculty interaction, including a vigorous program of field trips and student involvement in faculty research and professional activities.

Hofstra University is located in suburban Long Island, New York, about 25 miles from Manhattan. The university occupies a beautiful 240 acre campus that is also a registered arboretum and enrolls 8,000 full-time undergraduates and 4,000 graduate and part-time students. The Geology Department consists of four full-time and seven adjunct faculty and offers undergraduate degrees in Geology and Environmental Resources.

Applicants should have their Ph.D. completed by September 2009. Send a letter of introduction discussing your teaching and research interests, a curriculum vitae, and three supporting letters to Dr. Charles Merguerian, Chair, Dept. of Geology, 114 Hofstra University, Hempstead, NY 11549-1140, e-mail: [Charles.Merguerian@hofstra.edu](mailto:Charles.Merguerian@hofstra.edu). 31 December 2008 is the deadline for receipt of applications.

Hofstra University is an equal opportunity employer, committed to fostering diversity in its faculty, administrative staff and student body, and encourages applications from the entire spectrum of a diverse community.

**FACULTY POSITION AVAILABLE IN GEOSCIENCES  
THE UNIVERSITY OF TEXAS AT DALLAS**

The Dept. of Geosciences at the University of Texas at Dallas is seeking up to two tenure/tenure track faculty members in the broad field of tectonics with interests in fundamental processes and in the application of tectonic principles to energy and environmental issues. These positions are available for the 2009-2010 academic year and may be at any academic rank, depending on qualifications. We seek individuals who have developed, or have the potential to develop, vibrant, sustained externally funded research programs that complement existing departmental strengths and who will contribute effectively to the department's educational programs at the B.S., B.A., M.S., and Ph.D. levels.

This departmental expansion in tectonics will play a pivotal role in the University's strategic emphasis on energy and the environment. We are seeking individuals who will complement and expand departmental strengths

in structural geology, active and ancient tectonics, isotope geochemistry, geophysics, geospatial science, and computational geoscience, and who will enhance collaboration with other departments in the School of Natural Sciences and Mathematics and programs in geospatial science with the School of Economics, Political, and Policy Studies and the Jonsson School of Engineering and Computer Science. We hope to build upon our traditional collaboration with the petroleum industry in areas that may encompass carbon dioxide sequestration, water and mineral resources, and to expand the use modern high-resolution positioning and imaging technology to characterize and model surface processes associated with crustal deformation.

The Dept. of Geosciences has strong undergraduate and graduate programs and UTD is a relatively young, growing university. It attracts very talented students (mean freshman SAT >1200) and is situated in a vibrant metropolitan area that is undergoing rapid growth.

Applications will be reviewed beginning 15 January 2009 but will be considered until the positions are filled. Applications should include a complete resume, a statement of research interest and the names and contact information of five professional references and send to: **Academic Search #20097, The University of Texas at Dallas, 800 W. Campbell Road, AD 42, Richardson, TX 75080-3021.** Indication of gender and ethnic origin for affirmative action statistical purposes is requested as part of the application process but is not required for consideration.

Questions about the position may be directed to the Department Head, Professor John S. Oldow ([oldow@utdallas.edu](mailto:oldow@utdallas.edu)). Electronic applications can be sent to [jobsrch@utdallas.edu](mailto:jobsrch@utdallas.edu). UTD is an equal opportunity/affirmative action employer and encourages application from candidates who would enhance the diversity of the university's faculty and administration.

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

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

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

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

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

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

The University of Wisconsin-Madison is an equal-opportunity/affirmative action employer and encourages

applications from women and minorities. Employment may require a criminal background check.

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

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

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

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

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

**ISOTOPE GEOCHEMIST  
UNIVERSITY OF WISCONSIN-MILWAUKEE**

The Dept. of Geosciences at the University of Wisconsin-Milwaukee invites applicants for a faculty position in Isotope Geochemistry at the rank of Assistant or in exceptional cases, Associate Professor with a start date of August 2009. Applicants must hold a Ph.D. in geology or related field at the time of appointment, and have demonstrated research experience in isotope geochemistry. Post-doctoral experience is desirable. The successful candidate is expected to conduct an active, internationally recognized, externally funded research program. The successful candidate will teach an undergraduate/graduate course in isotope geology (stable and radiogenic), introductory courses and upper level undergraduate and graduate level courses in their field of expertise, and advise graduate student thesis projects. A normal teaching load is 3 courses per academic year. Information is available on-line regarding the Dept. of Geosciences at [www.uwm.edu/Dept/Geosciences/](http://www.uwm.edu/Dept/Geosciences/) and the College of Letters and Sciences at [www.uwm.edu/letsci/](http://www.uwm.edu/letsci/).

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

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

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

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

Qualifications:

- Earned Ph.D. in Physical Geography, GIS, or a related field is required.



**Dean, College of Geosciences**  
<http://geosciences.tamu.edu>

The College of Geosciences is seeking an exceptional individual as Dean. The holder of this position is the chief executive officer of the College with 110 tenured and tenure-track faculty members, 16 research scientists, 265 graduate students, 489 undergraduate students, and a total research and teaching budget of \$84 million. The College of Geosciences seeks to provide an understanding of our changing planet: the solid earth, the oceans, the atmosphere; coupled human and natural systems; and the application of state-of-the-science research to energy, environment and climate change. The College includes the Departments of Atmospheric Sciences, Geology and Geophysics, Geography, and Oceanography and a variety of research units including the Integrated Ocean Drilling Program, the Sea Grant College Program, and the Geochemical and Environmental Research Group. Close collaborations, through programs such as the Center for Atmospheric Chemistry and the Environment and the Sustainable Coastal Margins Program, exist with other colleges across the campus.

**TEXAS A&M IS SEEKING DISTINGUISHED, PROACTIVE, AND VISIONARY CANDIDATES WITH:**

- Dedication to the goals of the College of Geosciences and commitment to energizing and enhancing the activities of the College within and outside the university;
- Distinguished record of accomplishment in academia, industry, or government appropriate for a tenured full Professor in one of the Departments of the College;
- Proven and distinguished record of administrative service;
- Demonstrated ability to recruit, retain, and develop outstanding faculty, staff, and students;
- Clear and demonstrated commitment to excellence in research, undergraduate and graduate education, and active engagement with our federal, state, industry and community partners;
- Commitment to diversity, equal opportunity, and global perspectives;
- Commitment to leadership in fund-raising and obtaining enhanced external support.

Texas A&M University is in the ninth year of a long-range planning process entitled Vision 2020 (<http://www.tamu.edu/vision2020/>) with the goal of becoming a consensus "top 10" public university. So far, the University has raised over \$1.5 billion through a development campaign and has hired faculty for 442 new faculty lines, 26 of whom are in the College of Geosciences.

Bryan-College Station, home of Texas A&M University, consistently ranks as one of the most livable metropolitan areas in the nation. Centrally located among three of the country's 10 largest cities (Dallas, Houston, San Antonio) and just over an hour from the state capital (Austin), B-CS boasts a combined population in excess of 155,000, including the Texas A&M student body. The community has excellent school systems, shopping centers, hospitals, and restaurants. The twin cities are home to a high proportion of professional people and feature many of the advantages of a cosmopolitan center without the disadvantages of a congested urban environment.

The Search Advisory Committee will begin to review applications on November 15, 2008. The review will continue until the position is filled. Applicants should submit a letter of application, 1-2 page narrative summary of experience and administrative philosophy, curriculum vitae and the names and telephone numbers of at least three references. (References will be contacted only after permission is obtained from the candidate.) Applicants should also provide a preferred telephone number and mailing and e-mail addresses.

**PLEASE SEND APPLICATIONS AND NOMINATIONS TO:**

Dr. H. Joseph Newton, Chair  
Geosciences Search Advisory Committee  
Texas A&M University, College of Science  
3257 TAMU, College Station, Texas 77843-3257  
Phone: 979.845.8817 | Fax: 979.845.6077  
e-mail: [jnewton@tamu.edu](mailto:jnewton@tamu.edu)

*Texas A&M University is an Equal Opportunity and Affirmative Action Employer. The University is dedicated to the goal of building a culturally diverse and pluralistic faculty and staff committed to teaching and working in a multicultural environment. We strongly encourage applications from women, underrepresented ethnic groups, and individuals with disabilities.*

- Must demonstrate a commitment to excellence in teaching and research at the undergraduate, master's, and post-doctoral levels.
- Will be expected to develop a strong externally funded research program in geomorphology and/or GIS.
- Collaborative and interdisciplinary research is encouraged.

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

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

Review of applications began 30 November 2008; position will remain open until filled.

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

#### METEORITICS/PLANETARY SCIENCE TEXAS CHRISTIAN UNIVERSITY

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

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

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

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

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

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

The Dept. of Earth and Environmental Sciences at Vanderbilt University invites applications for a tenure-track faculty position in the general area of

Biogeoscience. This position, effective the Fall 2009 semester, is at the Assistant Professor level.

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

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

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

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

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

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

#### ASSISTANT OR ASSOCIATE PROFESSOR IN HYDROCARBON GEOSCIENCE GEOLOGY AND GEOPHYSICS DEPARTMENT AND ENERGY & GEOSCIENCE INSTITUTE UNIVERSITY OF UTAH

The Geology and Geophysics (GG) Department and the Energy & Geoscience Institute (EGI) at the University of Utah invite applications for a tenure-track faculty position in GG at the Assistant or Associate Professor level, beginning 1 July 2009. The successful candidate will bring expertise in hydrocarbon energy research and will develop a strong, externally funded and internationally recognized research program involving students and industry. Teaching responsibilities will include development of new undergraduate- and graduate-level courses and integration with existing courses in GG's Petroleum Industry Career Path. The appointee will participate in collaborative efforts between GG and EGI. The GG Department and EGI share thriving research and academic programs in petroleum geology and geophysics and allied areas of the geosciences, including EGI's Corporate Associate program. The position will have offices at both organizations, and communication and

leadership skills as well as teamwork experience are important. We also offer state-of-the-art facilities including the new Frederick A. Sutton Building. More information can be found online at [www.earth.utah.edu](http://www.earth.utah.edu) and [www.egi.utah.edu](http://www.egi.utah.edu).

The area of specialization is open but possibilities include geologic interpretation of geophysical data, new methodologies for subsurface imaging, petrophysics, rock fracture mechanics, reservoir characterization and engineering, multiphase fluid flow, and geostatistical modeling. Multiple opportunities for collaboration and funding exist, including capitalizing on emerging interest in unconventional resources.

Candidates must have a completed Ph.D. at the time of appointment and a strong record of research and publication. Applications are being accepted now; review of applications will begin on 15 January 2009, and will continue until the position is filled. Applicants should submit an application letter indicating research, teaching and programmatic interests and agenda, curriculum vitae, and names and contact information of three professional references to:

Chairs of the Hydrocarbon Geoscience Search Committee, Geology and Geophysics Dept., University of Utah, 135 South 1460 East, WBB 719, Salt Lake City, UT 84112.

Complete applications may also be sent in PDF format by email to [Kristin.Christensen@utah.edu](mailto:Kristin.Christensen@utah.edu). Questions can be addressed to [Cari.Johnson@utah.edu](mailto:Cari.Johnson@utah.edu) or [Ray.Levy@egi.utah.edu](mailto:Ray.Levy@egi.utah.edu).

The University of Utah is an equal opportunity/affirmative action employer, encourages applications from women and minorities, and provides reasonable accommodation to the known disabilities of applicants and employees.

The University of Utah values candidates who have experience working in settings with students from diverse backgrounds, and possess a strong commitment to improving access to higher education for historically underrepresented students.

#### TENURE-TRACK FACULTY POSITION IN EARTH AND ENVIRONMENTAL SCIENCE UNIVERSITY OF WISCONSIN-EAU CLAIRE

Earth and Environmental Science Education position available 24 August 2009. Completed Ph.D. in geology, environmental science, or closely related discipline is required at the time of appointment. This position requires a demonstrated ability to teach an inquiry-based, laboratory and field intensive introductory earth and environmental science course for the general education program and education majors (grades 1-9). Area of specialization is open, but should be focused on earth and environmental sciences, including but not limited to the interface of geology and biology, environmental remediation, microbes in the environment, or earth resources.

Interested individuals should provide a letter describing their background, qualifications for the position, a statement of teaching and research interests, a curriculum vitae, and unofficial copies of university transcripts. This packet should be sent via e-mail (PDFs strongly preferred) to [GeologyHire@uwec.edu](mailto:GeologyHire@uwec.edu). Three individual referees must submit letters of recommendation electronically or by mail to J. Brian Mahoney, Chair, Dept. of Geology, University of Wisconsin, Eau Claire, WI 54702-4004.

For a complete position description, call +1-715-836-3732 or visit [www.UWEC.edu/Geology](http://www.UWEC.edu/Geology). A criminal background check will be required prior to employment. UW-Eau Claire is an AA/EEO employer and encourages applications from women and minorities.

## Fellowship Opportunities

#### INTERDEPARTMENTAL POSTDOCTORAL FELLOWSHIP IN GEOSCIENCES, YALE UNIVERSITY

The Dept. of Geology and Geophysics at Yale University ([www.geology.yale.edu](http://www.geology.yale.edu)) seeks applicants for a post-doctoral fellowship in research that links geosciences (studies of the solid earth, oceans, atmosphere, climate, and the evolution of life) with other sciences, including, but not limited to, astronomy and astrophysics; environmental studies; physics; chemistry; biology; engineering; anthropology; medical science and public health; economics and political science.

This Postdoctoral Associate position is awarded for two years, contingent on satisfactory progress, and provides a stipend (\$49,000/yr) and base research funds (\$5,000/yr), plus health care benefits and limited expenses for relocation.

The Interdepartmental Postdoctoral Fellowship will have at least two faculty collaborators: the primary sponsor will be from Geology and Geophysics, while

others are from one or more other Yale departments. Interested candidates should first contact a faculty member in Geology and Geophysics to define a research theme and to identify other appropriate faculty collaborators. Applicants should submit a curriculum vita, a list of publications, an interdisciplinary research proposal (2–3 pages, in which the Yale collaborators are identified), and a brief letter of endorsement from each of the Yale faculty collaborators. Applicants should also arrange for three reference letters to be sent directly to the Department. The deadline for receipt of all application materials is 15 January 2009, and decisions will be announced by or shortly after 15 March 2009. Successful candidates are expected to begin their program at Yale between 1 July and 31 December 2009.

Application materials and reference letters should be sent by e-mail (interdepartmental.fellowship@geology.yale.edu) or by post: Interdepartmental Postdoctoral Fellowship, Yale University, Dept. of Geology and Geophysics, PO Box 208109, New Haven, CT 06520-8109. Yale University is an equal opportunity/affirmative action employer; applications from women and minority scientists are strongly encouraged.

#### BATEMAN POSTDOCTORAL FELLOWSHIPS IN GEOSCIENCES, YALE UNIVERSITY

The Dept. of Geology and Geophysics at Yale University ([www.geology.yale.edu](http://www.geology.yale.edu)) announces an annual competition for one or more **Bateman Postdoctoral Fellowships**. We welcome applicants with research interests across the full range of disciplines within the Earth Sciences, including studies of the solid earth, oceans, atmosphere, climate dynamics, geochemistry, paleoclimatology, and the evolution of life. Each of these Postdoctoral Associate positions is awarded for two years, providing a stipend (\$49,000/yr) and base research funds (\$5,000/yr), plus health care benefits and limited expenses for relocation. Applicants should contact a sponsor in the Department to identify potential research projects, and then submit a short (2–3 page) statement of research interests and proposed research, a curriculum vita, and list of publications. The sponsor's name should be clearly identified in the research statement. Applicants should also arrange for three reference letters to be sent directly to the Department. The deadline for receipt of all application materials is 15 January 2009, and decisions will be announced by or shortly after 15 March 2009. Successful candidates are expected to begin their program at Yale between 1 July and 31 December 2009.

Application materials and reference letters should be sent by e-mail (bateman.fellowship@geology.yale.edu) or by post: Bateman Postdoctoral Fellowship, Yale University, Dept. of Geology and Geophysics, PO Box 208109, New Haven, CT 06520-8109. Yale University is an equal opportunity/affirmative action employer; applications from women and minority scientists are strongly encouraged.

## Opportunities for Students

**Jonathan O. Davis Scholarship, Division of Earth and Ecosystem Sciences, Desert Research Institute.** The family and friends of Jonathan O. Davis, a prominent U.S. geologist and geoarchaeologist and a DRI faculty member, have established an endowment that provides a yearly national Jonathan O. Davis Scholarship, as well as a stipend for a University of Nevada–Reno student.

Jonathan was tragically killed in an automobile accident in December 1990. It is the wish of his family and friends to support graduate students working on the Quaternary geology of the Great Basin, research close to Jonathan's heart. The national scholarship is \$4,000 and the University of Nevada–Reno stipend is \$1,500.

The national scholarship, administered by the Division of Earth and Ecosystem Sciences of the Desert Research Institute, is open to graduate students enrolled in an M.S. or Ph.D. program at any university in the United States. The stipend, also administered by the Division of Earth and Ecosystem Sciences, is open to graduate students enrolled in an M.S. or Ph.D. program at the University of Nevada–Reno. Quaternary geology, as used here, encompasses a wide range of topics normally considered as part of the Quaternary sciences. The research, however, must have a substantial geologic component or demonstrate a strong reliance on geologic techniques and must be focused on the Great Basin.

- Applications should include
- A cover letter explaining how the individual qualifies for the award. Please include your social security number and state whether you are applying for the (1) national scholarship or for the (2) UNR stipend.
- A current résumé or vitae.

- A two-page, single spaced description of the thesis/dissertation research, which also clearly documents the geological orientation and research significance. Figures, tables, and references do not count against the two-page limit.
- A short statement on how funding would be used.
- A letter of recommendation from the thesis/dissertation supervisor, which emphasizes the student's ability and potential as a Quaternary scientist.

Applications must be post-marked by 2 February 2009. Proposal reviews will not be returned to applicants. Applications should be addressed to Executive Director, Division of Earth and Ecosystem Sciences, Desert Research Institute, 2215 Raggio Pkwy, Reno, NV 89512.

**If you have further questions regarding the awards or the application process, please contact Barbara Jackson at +1-775-673-7454 or bj@dri.edu.**

**Ph.D. in Carbonate Geochemistry and Global Ocean-Climate Change, Department of Marine Sciences, University of North Carolina–Chapel Hill.** The Ries Laboratory (<http://marine.unc.edu/people/Faculty/JRIES>) in the Dept. of Marine Sciences at the University of North Carolina–Chapel Hill seeks a doctoral student interested in conducting research on the relationship between global ocean-climate change and marine calcification, to begin Fall 2009. Research will include field investigations of modern (e.g., coral reefs) and/or ancient (e.g., limestones) carbonate systems coupled with laboratory calcification experiments. This opportunity affords access to state-of-the-art analytical equipment, including LA-ICP-MS for trace element analysis, XRD for mineralogical characterization, isotope mass spectrometry for  $^{34}\text{S}$ ,  $^{13}\text{C}$ , and  $^{18}\text{O}$ , and SEM with microprobe for micro-imaging and elemental mapping. In addition to completing coursework in the four core oceanographic disciplines—geological, chemical, biological, and physical oceanography—the student will receive in-depth training in carbonate geochemistry, carbonate sedimentology, biomineralization, global ocean-climate change, and paleoceanography, which will directly support his/her research objectives. The student will also have access to the department's coastal laboratory in Morehead City, North Carolina—the UNC Institute of Marine Science. Highly motivated and creative individuals are encouraged to send a CV and a two-page research plan to Prof. Justin Ries, Dept. of Marine Sciences, UNC–Chapel Hill, CB#3300, Chapel Hill, North Carolina, 27599, jries@unc.edu.

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

Applications for graduate study at Case are accepted on a rolling basis, though students requesting financial assistance in Fall 2009 are encouraged to apply by 1 February 2009. CWRU is committed to diversity and equality. Students from all backgrounds are encouraged to apply.

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

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

to three years. Additional funding is available to cover some laboratory and field expenses.

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

New Mexico Tech is a highly rated science and engineering university with more than 60 earth science faculty shared between the academic division and the Bureau. More complete descriptions of the fellowship, of New Mexico Tech, and of the Bureau are available at [www.nmt.edu/](http://www.nmt.edu/) and <http://geoinfo.nmt.edu/>.

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

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

**New Mexico Highlands University, Graduate Assistantship.** Graduate assistantships are available for students wishing to pursue an M.S. in Geology beginning Fall 2009 term. The NMHU Environmental Geology Program offers a field-intensive curriculum emphasizing earth materials, mineral-rock-water interactions, environmental geophysics, and natural geologic hazard assessment. Program strengths are in mineralogy, petrology, geochemistry, rock-paleomagnetism, structural geology, volcanology, and collaborative endeavors with the Forestry Program and the New Mexico Forest and Watershed Restoration Institute. New NSF-Funded Paleomagnetic-Rock Magnetism and Water Chemistry laboratories allow for numerous student and collaborative research opportunities. Nestled in the foothills of the Sangre de Cristo Mountains, Highlands' campus has been cited as one of New Mexico's best-kept secrets. A low student:faculty ratio, state-of-the-art laboratory facilities, and committed faculty provide students with a superior learning experience. The graduate assistantship includes a stipend of \$10,100 and tuition waiver per academic year. Application review begins 01/15/08. For more information, contact Dr. Michael Petronis, Environmental Geology, Natural Resource Management Department, New Mexico Highlands University, Box 9000, Las Vegas, New Mexico 87701, [mspetro@nmhu.edu](mailto:mspetro@nmhu.edu). For disabled access or services call +1-505-454-3513 or TDD# +1-505-454-3003. AA/EOE Employer.

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



**Colorado School of Mines  
Geology and Geological Engineering  
Assistant Professor – Geological  
Engineer**

Colorado School of Mines invites applications for an anticipated tenure-track Assistant Professor in the Department of Geology and Geological Engineering to begin in August 2009. Information about the school and the department can be found at <http://www.mines.edu/Academic/geology>.

The successful candidate will be expected to teach at both the undergraduate and graduate levels, supervise graduate research and thesis projects, establish a quality publication record, and develop a strong externally funded research program.

Candidates must possess a doctoral degree in geological engineering or a related engineering discipline, and be registered as a professional engineer or meet the qualifications to become registered. The candidate must demonstrate the potential for successful teaching and possess strong interpersonal and communication abilities. Desired are candidates with the credentials / experience to participate in interdisciplinary initiatives related to subsurface geo-engineering research.

For a complete job announcement and the instructions for applying, see the complete announcement at <http://www.mines.edu/Academic/Faculty>.

CSM is an EEO/AA Employer.

**University of Cincinnati**

**Head, Department of Geology,  
University of Cincinnati (28UC2552)**

The Department of Geology, University of Cincinnati, invites nominations and applications for the position of Department Head at the Associate Professor or Professor level. Candidates must have a Ph.D. in Geology and a strong scholarly record. Only candidates who will have tenure at the time of appointment will be considered. Candidates should possess demonstrated leadership and administrative skills and have a commitment to faculty growth and development, improved external funding, the promotion of interdisciplinary activity, and to quality graduate and undergraduate education. The successful candidate will promote the Department of Geology and the discipline within the McMicken College of Arts and Sciences and the University of Cincinnati and the larger community. The successful candidate will be expected to maintain an active research and teaching program in addition to serving a five-year renewable term as Department Head.

The Department of Geology at the University of Cincinnati is a moderate sized faculty with major strengths focused in paleoecology/paleobiology, Quaternary geology/surficial processes, and stratigraphy/sedimentology. We seek to augment and build upon these disciplines while expanding in new directions. Although the research specialization of candidates for this position is not tightly specified, strong consideration will be given to candidates in one of the following fields that complement departmental strengths: remote sensing, climatic modeling, isotope geochemistry/biogeochimistry, or biodiversity.

Only online applications will be considered. Applicants should apply online at <https://www.jobstatuc.com> [search for Position #: 28UC2552] submitting a letter of application, a curriculum vita, a short summary of research interests (3-5 pages) and teaching philosophy (1-2 pages). The applicant should have three letters of recommendation sent separately to Ms. Kim Carey, Geology Headship Search Committee, PO Box 210172, University of Cincinnati, Cincinnati, OH 45221-0172 or by email as pdfs to [kim.carey@uc.edu](mailto:kim.carey@uc.edu). Complete applications will be reviewed starting **December 8, 2008** and the search will remain open until the position is filled. The University of Cincinnati is an affirmative action/equal opportunity employer. Women, minorities, disabled persons, and Vietnam Era and disabled veterans are encouraged to apply.

The University of Cincinnati is an affirmative action/equal opportunity employer. UC is a smoke-free work environment.



**Available through GSA**

**THE  
GEOSCIENCE  
HANDBOOK**

Published by the American Geological Institute.

**AGI DATA SHEETS • FOURTH EDITION**

Compiled by J. Douglas Walker and Harvey A. Cohen

One of the best-kept secrets in geology is this handy compilation of geological information. The essential reference for geoscientists in the field, office, or lab, *The Geoscience Handbook* provides quick reference for the key metrics and concepts, as well as short tutorials on subjects that may not be familiar to all geoscientists. The *Handbook* covers diverse subjects, from geophysics to geologic map symbols to GPS usage, and everything in between! Updated in 2006, *The Geoscience Handbook* is now a larger, but still portable, format for easier reading. Also now in full color, the *Handbook* uses color photos when possible to better illustrate geology in the real world.

DATASHEETS, 300 p., 5" x 8", spiral bound, ISBN 0-922152-75-6, \$49.95, **member price \$39.95**

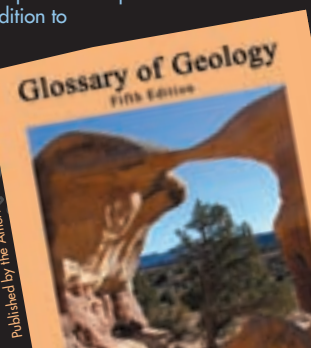


**Glossary of Geology** Fifth Edition

Klaus K.E. Neuendorf, James P. Mehl, Jr., and Julia A. Jackson, editors

The fifth edition of the *Glossary of Geology* contains nearly 40,000 entries including 3600 new terms and nearly 13,000 entries with revised definitions from the previous edition. Additions and changes reflect both advances in scientific thought and changes in usage making this 800+ page hardbound reference tool indispensable to professional earth scientists and students. In addition to definitions, many entries include aids to syllabication and background information. The *Glossary* draws its authority from the expertise of the more than 100 geoscientists in many specialties who have reviewed definitions and added new terms.

Product code: Glossary  
list price \$99.00  
**member price \$80.00**



**GSA SALES AND SERVICE** P.O. Box 9140, Boulder, CO 80301-9140, USA  
+1.303.357.1000, option 3 • Toll-free +1.888.443.4472 • Fax +1.303.357.1071

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



**THE GEOLOGICAL SOCIETY  
OF AMERICA®**

# Journal Highlights

## NOV./DEC. GSA BULLETIN

- Dust in the Quaternary wind
- Oxygen deprivation in the Cretaceous
- Seattle sleeping on a thrust wedge
- Subsidence in Mexico shifts eastward



## DECEMBER GEOSPHERE

- SHRIMP-y systematics at Angel Lake
- Piggybacking across the basin
- Extended evolution of the south Balkan system
- Playful paleoevents in southwestern sediments



GSA's online journal.

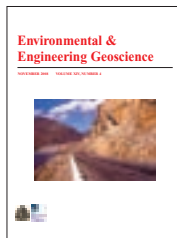
## DECEMBER GEOLOGY

- Seesaws in the South Atlantic
- Taking the Pulse of a Feverish Volcano
- Stone Age Predates *Homo sapiens*
- Pollen Takes us Higher in the E-O



## NOVEMBER ENVIRONMENTAL & ENGINEERING GEOSCIENCE

- Graduate drains landslides
- Leaky pavement?
- Designing debris deflectors
- Soil amplifies quake waves
- Fissures follow failure



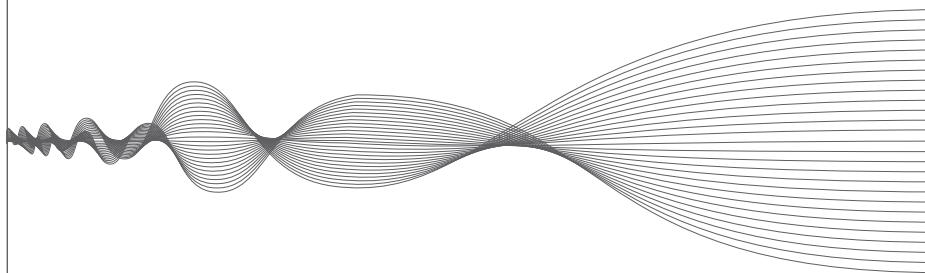
TO SUBSCRIBE, CONTACT

gsaservice@geosociety.org, or call

+1-888-443-4472, or +1-303-357-1000, option 3.

Look for open access articles and more at

[www.gsjournals.org](http://www.gsjournals.org)



## Rafter Radiocarbon dating services and Stable Isotope science

Our AMS  $^{14}\text{C}$  dating services are complimented by  $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ ,  $\delta^{34}\text{S}$ ,  $\delta^{18}\text{O}$  and hydrogen stable isotope analysis. We offer a 10% discount for jobs requiring all five stable isotopes.

Our analysis is backed by world-leading scientists whose research spans climate, environmental protection and sustainability, geology, and hydrocarbons, supported by expert technicians.

Whether you seek knowledge of "a moment in time" from radiocarbon dating, or "inside knowledge" of isotope processes, GNS Science can provide the answers.

To know more about benefitting from the expertise of the GNS Science Stable Isotope Laboratory and Rafter Radiocarbon Laboratory please visit

[www.rafterradiocarbon.co.nz](http://www.rafterradiocarbon.co.nz)

[www.gns.cri.nz/nic/stableisotopes](http://www.gns.cri.nz/nic/stableisotopes)

or Email us at

[radiocarbon@gns.cri.nz](mailto:radiocarbon@gns.cri.nz)

[stableisotopes@gns.cri.nz](mailto:stableisotopes@gns.cri.nz)

### Location

National Isotope Centre  
30 Gracefield Road  
Lower Hutt 5010  
PO Box 31312  
Lower Hutt 5040  
New Zealand  
T +64-4-570 4647  
F +64-4-570 4657



## Articles Coming Soon

to *GSA Today*

- \* 2008 Presidential Address
- \* 2008 GSA Awards and Medals
- \* 2008 GSA Honorary Fellows



# Diverse opportunities are yours to explore

Whether you're a seasoned professional or just beginning your geosciences career, you'll find your niche in the BC Public Service.

B.C. offers one of Canada's most varied landscapes, with opportunities in mineral exploration, petroleum and mining. You'll have unparalleled career options including more responsibility and diversity within your role. Grow your career and discover a rewarding future in geology with the BC Public Service.

**John**, Regional Geologist



For more information about careers with the BC Public Service,  
please visit: [employment.gov.bc.ca](http://employment.gov.bc.ca)



Where ideas work

