Canada’s craton: A bottoms-up view

Inside this issue:
- Comment: Impacts, mega-tsunami, and other extraordinary claims, p. 11
- Penrose Conference Scheduled, p. 46
It's Not Just Software... It's RockWare.
For Over 24 Years.

**RockWorks™**
3D Data Management, Analysis, and Visualization
- Powerful measured-section/borehole database for managing:
  - Lithology - Stratigraphy
  - Hydrology - Fractures
  - Hydrochemistry (e.g. Contaminants)
  - Hydrology - 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
$2,499 Commercial/$899 Academic

**DeltaGraph™**
The Most Comprehensive Charting Application Available
- Analyze, visualize and customize your numbers efficiently with high quality output
- Formula Builder with 50 mathematical/statistical functions
- Curve fitting with advanced regression tools
- Over 80 different chart types and 200 different styles
- High quality screen and printer output
$295 Commercial/$175 Academic

**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
$599

**The Geochemist’s Workbench™**
GWB is the premiere software solution for simulation of:
- Scaling
- Souring
- Flooding
- Formation damage
- Frac jobs
- Fluid compatibility
GWB Professional
$7,999
1D/2D Reactive Transport Modeling
GWB Standard
$3,499
Reaction Path Modeling

303.278.3534 • 800.775.6745
RockWare.com
4  Canada’s craton: A bottoms-up view
Dante Canil

Cover: Polymetamorphic gneiss with an age of ca. 3.3 Ga from near Mackay Lake, in the central Archean Slave Province, Canada. Diamondiferous kimberlites ascended through these basement gneisses and sampled peridotite xenoliths from the underlying cratonic mantle root en route to the surface. Photo courtesy of W. Bleecker, Geological Survey of Canada. See “Canada’s craton: A bottoms-up view” by D. Canil, p. 4–10.

11 Comment: Impacts, mega-tsunami, and other extraordinary claims
Canada’s craton: A bottoms-up view

Dante Canil, School of Earth and Ocean Sciences, University of Victoria, 3800 Finnerty Road, Victoria V8W 3P6, British Columbia, dcanil@uvic.ca

ABSTRACT
The origin of mantle lithosphere underlying Archean crustal provinces is most consistent with depletion at low pressures in the spinel facies under degrees of melting higher than observed in modern ocean basins. Depleted sections of the lithosphere created in convergent margin settings were underthrust and stacked to build a thick root with time. Geochronologic and geologic evidence can be interpreted to show that the final formation and amalgamation of the bulk of the “mantle root” occurs 0.5–1 b.y. later than the age of the lithosphere from which it is comprised. “Silica enrichment” is not ubiquitous in the mantle beneath Archean crustal provinces. Where it does occur, it may be a heterogeneous feature possibly imparted by marine weathering of peridotite on the Archean ocean floor before it was stacked to form a mantle root.

INTRODUCTION
Cratons are defined as stable portions of the continental plates that have escaped tectonic reworking for long periods (giga-annum [Ga]). Thirty-five Archean crustal provinces are recognized within the cratons of continents today (Bleeker, 2003). The largest mass of lithosphere beneath these cratons underlies the Moho in the mantle. Thus, the long-term strength and stability of a craton must be engendered in the properties of its mantle lithosphere, which may ultimately be tied to the origins of continents themselves.

The purpose of this review is to summarize some thermal, petrological, and geological constraints on the evolution of cratonic lithosphere as sampled by kimberlites in Canada. Canada is centered over a large craton and has the largest proportion of Archean crust in the world exposed at its surface, making it the focus of diamond exploration in the past 15 years. A significant portion of the Lithoprobe program was devoted to the geophysical imaging of lithosphere beneath the craton (Fig. 1). The geophysical surveys in this and other such programs (e.g., DeepProbe, Kaapvaal project, USArray) provide a present-day interpretation of the deep lithosphere but by themselves do not explain its origin and evolution. Mantle rocks sampled as xenoliths provide the only “in place” record of Archean and younger processes beneath cratons, hence providing us with a link between the deep lithosphere, surface geology, and geophysical data (Carlson et al., 2005).

Figure 1. Precambrian basement map of North America stripped of its Phanerzoic sedimentary cover (after Hoffman, 1988, 1990; Ross et al., 1991). Boxes show locations of various geophysical transects within the Lithoprobe program. Also shown are kimberlite fields, clusters, and pipes, clockwise from top: SI—Somerset Island; O—Otish Mountains/Renard; KL—Kirkland lake; T—Timiskaming; WW—Wawa; L—Lake Ellen; S—Stockdale; A—Attawapiskat; K—Kyle Lake; IM—Iron Mountain; SL—State Line; W—Williams; C—Crossing Creek; FL—Fort a la Corne; BH—Buffalo Hills; D—Drybones Bay; G—Gahcho Kue; LG—Lac de Gras; J—Jericho.
PALEOGEOOTHERMS AND THE THERMAL HISTORY OF CRATONS

The cooling of the earth and the distribution of its heat sources have long been of interest (Pollack and Chapman, 1977; Verhoogen, 1956) but with few direct constraints. I examine the cooling history of cratons with a focus on the Archean Slave Province in Canada using available heat flow measurements, geochronological data, and pressure-temperature (P-T) data for xenoliths that cover a 300 km length of the province (Fig. 2). The P-T data are based on analyses from the same electron microprobe laboratory, eliminating interlaboratory inconsistency and enhancing precision.

The P-T arrays of xenoliths from the Galcho Kue, Grizzly, and Jericho pipes in the Slave Province are identical within error of the thermobarometers applied, despite the fact that these kimberlites vary in age by 500 m.y. (Fig. 3). I fit the error of the thermobarometers applied, despite the fact that and Jericho pipes in the Slave Province are identical within inconsistency and enhancing precision.

The P-T arrays of xenoliths from the Galcho Kue, Grizzly, and Jericho pipes in the Slave Province are identical within error of the thermobarometers applied, despite the fact that these kimberlites vary in age by 500 m.y. (Fig. 3). I fit the P-T arrays to a “steady state” geotherm with input parameters of (1) surface heat flow, heat generation, and crustal thickness measured in the central Slave Province (Mareschal et al., 2004); (2) crustal heat generation of 0.6 μWm⁻² (Rudnick and Nyblade, 1999; Russell et al., 2001); and (3) an empirical fit of change in thermal conductivity with depth (MacKenzie and Canil, 1999).

The thermal structure of the Slave Province mantle has not changed significantly in the past 500 m.y. over a scale of ~300 km (Fig. 3). The uniform thermal structure contrasts with the petrologic structure, which varies vertically and laterally across the province. In plan view, the Slave mantle structure consists of three NE-striking ribbons of lithosphere with different levels of depletion, as deduced by garnet geochemistry (Grütter et al., 1999), that parallel slight changes in the direction of seismic anisotropy (Davis et al., 2003b) (Fig. 2). The vertical distribution of mantle peridotite in the ~180–220-km-thick lithosphere consists of a shallow, ultra-depleted layer underlain by a deeper, more fertile layer (Griffin et al., 1999a; Kopylova and Russell, 2000; Kopylova and Caro, 2004). The ultra-depleted layer tapers to the southwest near Drybones Bay, where its base coincides with changes in seismic anisotropy over a narrow interval between 110 and 130 km depth (Carbno and Canil, 2002). This seismic discontinuity has been interpreted as the remnant of a lithospheric underthrust or “stack” (Bostock, 1998).

Although Slave Province mantle can be considered to be in a thermal steady-state at the time of sampling by kimberlites over the past 550 m.y., this state reveals nothing of when this equilibrium was reached, which, given the thermal time constant for 200-km-thick lithosphere, is ~1–2 by. (Mareschal and Jaupart, 2006). Furthermore, the paleogeotherm gives no direct information on the mantle heat flow at the end of the Archean when the Slave Province is presumed to have “stabilized.” If the lithosphere was to remain strong and stabilize the craton, its initial temperature must have been below the steady-state regime, with basal heat flow the same as today (Mareschal and Jaupart, 2006), a condition made permissible if the lithospheric root formed by accretion of “cold” subducting plates.

AGE OF CRATONIC MANTLE “ROOTS”

The Re-Os isotopic system has been employed extensively to estimate the age of peridotitic mantle lithosphere (Pearson, 1999). The Re/Os ratio of mantle residue decreases with melt extraction and over time evolves to low 187Os/188Os isotopic ratios. Some measure of the minimum age of the lithosphere can be made from 187Os/188Os by assuming all Re was lost on melting to produce a “Re depletion age” (Tᵣᵣ) of a sample. The Tᵣᵣ for kimberlite-borne mantle xenoliths from the Slave, Wyoming, and North Atlantic (Somerset Island) provinces

![Figure 2. Geological map of the Archean Slave Province (modified after Davis, 2003b; Kopylova and Caro, 2004) distinguishing Mesoarchean basement (deeper pink) from more juvenile crust to the east. Also shown are the electrical conductivity anomalies in the central Slave upper mantle (Jones et al., 2001) and northeast-trending mantle domains of varying azimuth of S-wave anisotropy (arrows) in the craton (Davis et al., 2003b; Grütter et al., 1999). Kimberlites (some labeled) are shown as blue dots.](image-url)
are the same as most other Archean provinces (Fig. 4). These ages established that melt extraction to form cratonic lithosphere is dominantly Archean, with some samples showing Proterozoic and younger modification (Carlson et al., 2005; Pearson, 1999). A similar age of melt extraction emerges from a whole-rock Lu-Hf isochron of peridotites in Somerset Island (Schmidberger et al., 2002).

Mantle lithosphere ages correspond with crustal ages in Archean provinces, leading to the inference that cratonic mantle roots formed and were coupled to their overlying Archean crust within a narrow time frame and have remained there ever since. This scenario poses a paradox. Several late and post-Archean events attributed to heating and/or orogenic activity are recorded in the upper and lower crust of cratons in both the Slave and Superior provinces, as indicated by late- and post-Archean ages of (1) metamorphic zircon in kimberlite-hosted lower crustal granulite xenoliths (Davis et al., 2003a; Moser and Heaman, 1997); (2) “granite blooms” in greenstone belts (Davis et al., 2003b); and (3) hydrothermal mineralization in lode gold deposits (Fig. 4). These widespread thermal events would be at odds with simultaneous development below a well-established, deep “cold” Archean lithospheric root as recorded by its Re depletion ages. Simple one-dimensional thermal modeling shows that a thermal pulse causing melting and metamorphism in the lower crust to form late granite blooms need not have thermally imprinted the entire craton root (Davis et al., 2003b). Alternatively, a recent geodynamic model proposes that cratonic lithosphere inverted its eclogite-bearing root during the latest Archean, causing melting in its lowermost crust (Percival and Pysklywec, 2007). Both of the above models hinge on when the “root” was established and stabilized.

There is some reason to recognize the resolution and limitations of the Re-Os model ages for mantle lithosphere. More than half of the Os in mantle peridotites can reside in micron-sized platinum group minerals (PGMs), which have a high-temperature stability and high partition coefficient for platinum group elements (Luguet et al., 2007). The PGMs can remain stable throughout the melting interval and may be recycled into later generations of lithosphere, accounting for the anomalously old Os ages (0.5–1.0 Ga) recorded in geologically young lithosphere in modern ocean basins (abyssal peridotites, Fig. 4). Given this attribute of the Re-Os system (Meibom et al., 2002), it is conceivable that the $T_{RD}$ of many cratonic xenolith samples may record the Os in PGMs that have been preserved from prior (Archean) melting events but that were later recycled into younger “roots.”

Eclogite xenoliths also call into question purely Archean “root formation.” Eclogite xenoliths are interpreted by many to be representative of oceanic basaltic crust now embedded in cratonic mantle roots by lithosphere subduction or stacking (Helinstaedt and Schulze, 1989; Jacob, 2004). The eclogites occur at various depth intervals throughout the Slave province mantle root (Kopylova et al., 1999). Based on Lu-Hf and U-Pb zircon systematics, these eclogites are demonstrably younger than the majority of $T_{RD}$ for mantle peridotites (Fig. 4), but correspond to identical ages of Paleoproterozoic subduction (ca. 2.0 Ga) recorded in surface geology at the extermines of this Archean province (Schmidberger et al., 2007). If Proterozoic eclogite is a component of the root, then “root” formation must be Proterozoic even if Archean peridotite constitutes the
bulk of the lithosphere. Thus, the age of the “root” formation may be younger than the age of the lithosphere that comprises the root. This hypothesis is consistent with U-Pb ages from lower crustal granulite xenoliths, which show that the Slave craton root cooled through the U-Pb blocking temperature of metamorphic rutile (~400 °C) to a present-day cratonic geotherm only by ca. 1.8 Ga, well after the Archean (Fig. 4). Similarly, 1.9-Ga sedimentary basins on the Slave Province record subsidence on a thinner, root-free thermal lithosphere at that time (Grotzinger and Royden, 1990).

Most intriguing is that the Re-Os ages of sulfides in kimberlite-borne diamonds sampled from the Slave Province, presumably hosted in the lithosphere, are ca. 3.5 Ga (Aulbach et al., 2004; Westerlund et al., 2006) and pre-date the NeoArchean (2.8–2.55 Ga) formation and amalgamation of overlying crust by at least 0.5 b.y. A similar pattern is evident in the Superior Province of Canada (Stachel et al., 2006) and in Kaapvaal of southern Africa (Richardson et al., 2001). In the mantle, sulfide is molten and potentially mobile, and Os has a low closure temperature (~400 °C) to a present-day U-Pb blocking temperature of metamorphic rutile (~400 °C), with Al/Si that is a consequence of partial melt extraction (Pearson et al., 2003) to an equation of 

\[
[Mg/Si] = 1.44(2) \times [Al/Si] + 3.66(11) \quad [\text{Al/Si}] \quad (95\% \text{ confidence}, r = 0.79). \]

Samples to the left or right of this line have a positive or negative “ΔMg/Si” value. The remaining panels show all (B) cratonic spinel-facies and (C) cratonic garnet facies mantle xenoliths.

**Mantle Lithosphere**

Mantle lithosphere is a residue of melt extraction from peridotite, which at pressures below ~3 GPa produces olivine at the expense of all other phases and increases its Mg/Fe with depletion. This attribute of the melting process is reflected geochemically in residual peridotites by increasing Mg/Si with increasing Mg/(Mg + Fe), as exhibited by peridotites sampled in modern ocean basins, ophiolites, orogenic massifs, or continental basalt-hosted xenoliths (Fig. 5). Most cratonic lithosphere is distinct from the latter by being depleted in Fe (high Mg#) but having variable Mg/Si (Figs. 5B and 5C) (Boyd, 1989). The compositional spectrum of low Fe and high Si in cratonic peridotites is unattainable by melting of primitive mantle peridotite at any pressure (Walter, 2005), but could be explained if they were residues of a more Si-rich and Fe-poor chondritic mantle, which has, since the Archean, escaped sampling during Proterozoic and younger melting processes (Francis, 2003). The trend to higher Si at a given Mg# could also be due to a secondary process (Herzberg, 2004; Kelemen et al., 1998).

**TECTONIC SETTING FOR CRATONIC LITHOSPHERE**

Global data sets of all types of mantle peridotites show a covariation of Mg/Si with Al/Si that is a consequence of partial melt extraction (Pearson et al., 2003) and can be fitted to a line: 

\[
[Mg/Si] = 1.44(8) - 3.66(11) \quad [\text{Al/Si}] \quad (r = 0.79, 95\% \text{ confidence}) \quad (\text{Fig. 6}). \]

Samples scatter to each side of that line, having higher or lower Mg/Si (hereafter referred to as ΔMg/Si), respectively, at a given degree of depletion (Al/Si). The ΔMg/Si of cratonic xenoliths can be compared with off-craton mantle to rigorously examine
the ubiquity (or not) of Si enrichment (low Mg/Si). The ΔMg/Si for cratonic mantle as a whole is normally distributed about zero, similar to other kinds of mantle lithosphere (Fig. 7). Thus, “Si enrichment” in cratonic mantle is an exception, occurring in a minority of samples. Indeed, the lower Mg/Si (or negative ΔMg/Si) observed in some cratonic peridotites is prevalent mostly in South Africa (Fig. 7). In modern abyssal peridotites, low Mg/Si at a given degree of depletion is a consequence of seafloor exposure and marine weathering (Snow and Dick, 1995). It appears possible that the lower Mg/Si (i.e., Si enrichment, negative ΔMg/Si) in some cratonic mantle is due to marine weathering, if its protoliths were at one time exposed to Archean seawater and later subducted to form a craton root.

Unlike Si enrichment, Fe depletion in cratonic mantle is ubiquitous (Fig. 5). Given current experimental data, generating the low Fe in cratonic peridotites from primitive mantle sources can only occur by melting at high pressures (>5 GPa; Walter, 2003). This has led to the belief that cratonic mantle is a residue of high-pressure melting in plumes and attaches to the craton root vertically by “plume subcretion” (Aulbach et al., 2007; Griffin et al., 1999a). This mode of origin at pressures >5 GPa is inconsistent with a number of trends in Cr, Al, and mildly incompatible elements in peridotite, which preclude extensive melting at pressures greater than 3 GPa (Canil, 2004; Canil and Wei, 1992; Kelemen et al., 1998; Kesson and Ringwood, 1989; Stachel et al., 1998).

If produced at low pressure, low Fe in cratonic peridotites requires either a source with higher Mg# or melting under conditions that greatly change the distribution of Fe from Mg. Because Fe³⁺ is ten times more incompatible than Fe²⁺ (Canil et al., 1994), melting at higher oxygen fugacity (fO₂) results in a residue with higher Mg/Fe for a given degree of melting. No experimental studies directly investigate the effect of fO₂ on major element systematics (Mg/Fe) of mantle melting, but this effect can be examined using the behavior of vanadium (V), which is mildly incompatible and redox sensitive (Canil, 2002). The lower V at a given degree of depletion in many cratonic peridotites could result from melting at higher fO₂. If this is correct, then by analogy with modern settings, the mantle now beneath Archean crustal provinces was generated in the upper plate of a convergent margin, consistent with a “stack” origin.

The lack of correlation of Mg# in olivine with modal olivine also distinguishes cratonic peridotites from Phanerozoic or
Further correlation of geophysical and geological observations different closure properties for different isotopic systems in this idea but is made difficult by their equilibration above the lithosphere age and the age of actual mantle "root" or "stabilized early continents may explain the time lag of 0.5–1 b.y. between (Korenaga, 2006) may also be part of the answer. Slower plates key, but more sluggish plate tectonics proposed for the Archean (Davies, 1992)? The level of depletion in mantle roots seems the tral buoyancy, required for shallow subduction and "stacking" differ enough from the present-day to engender a more neu- blication purposes to support their cratonic roots against removal into the convecting mantle (Jordan, 1975; Lee, 2003; Poudjom Djomani et al., 2001).

SUMMARY
The weight of thermal, petrologic, and geological evidence points toward an origin for lithosphere beneath Archean provinces in a convergent margin. Most of that lithosphere is Archean in age, but many lines of evidence show that the deep lithosphere beneath these regions did not “stack” or stabilize a “root” until at least 0.5 b.y. later. If so, was Archean crust tectonically emplaced atop the mantle lithosphere in a stack that in North America is more appropriately described as early Proterozoic in age? Why does lithospheric stacking not occur today? Did plate thicknesses and lengths in the Precambrian differ enough from the present-day to engender a more neutral buoyancy, required for shallow subduction and “stacking” (Davies, 1992)? The level of depletion in mantle roots seems the key, but more sluggish plate tectonics proposed for the Archean (Korenaga, 2006) may also be part of the answer. Slower plates and fewer convergent margins with a smaller proportion of early continents may explain the time lag of 0.5–1 b.y. between lithosphere age and the age of actual mantle “root” or “stabilization.” Better chronometry of mantle rocks would help test this idea but is made difficult by their equilibration above the closure temperatures of many isotopic systems. This challenge is also an opportunity. The cooling rates of the continents and the transient thermal signals therein (Michaut and Jaupart, 2007) have the potential to be understood by the different closure properties for different isotopic systems in mantle minerals from cratonic xenoliths (Bedini et al., 2004). Further correlation of geophysical and geological observations to the petrology and geochronology of xenoliths in cratons densely sampled by kimberlites can address these questions.

ACKNOWLEDGMENTS
I give credit to R. Clowes for his energy and leadership in Canada’s Lithoprobe program and thank M. Bostock, J. Percival, and S. Johnston for their reviews. Research summarized here was supported in part by Lithoprobe and Discovery Grants from the Natural Sciences and Engineering Research Council of Canada.

REFERENCES CITED

SUMMARY
The weight of thermal, petrologic, and geological evidence points toward an origin for lithosphere beneath Archean provinces in a convergent margin. Most of that lithosphere is Archean in age, but many lines of evidence show that the deep lithosphere beneath these regions did not “stack” or stabilize a “root” until at least 0.5 b.y. later. If so, was Archean crust tectonically emplaced atop the mantle lithosphere in a stack that in North America is more appropriately described as early Proterozoic in age? Why does lithospheric stacking not occur today? Did plate thicknesses and lengths in the Precambrian differ enough from the present-day to engender a more neutral buoyancy, required for shallow subduction and “stacking” (Davies, 1992)? The level of depletion in mantle roots seems the key, but more sluggish plate tectonics proposed for the Archean (Davies, 1992)? The level of depletion in mantle roots seems the tral buoyancy, required for shallow subduction and "stacking" differ enough from the present-day to engender a more neu- blication purposes to support their cratonic roots against removal into the convecting mantle (Jordan, 1975; Lee, 2003; Poudjom Djomani et al., 2001).

SUMMARY
The weight of thermal, petrologic, and geological evidence points toward an origin for lithosphere beneath Archean provinces in a convergent margin. Most of that lithosphere is Archean in age, but many lines of evidence show that the deep lithosphere beneath these regions did not “stack” or stabilize a “root” until at least 0.5 b.y. later. If so, was Archean crust tectonically emplaced atop the mantle lithosphere in a stack that in North America is more appropriately described as early Proterozoic in age? Why does lithospheric stacking not occur today? Did plate thicknesses and lengths in the Precambrian differ enough from the present-day to engender a more neutral buoyancy, required for shallow subduction and “stacking” (Davies, 1992)? The level of depletion in mantle roots seems the key, but more sluggish plate tectonics proposed for the Archean (Davies, 1992)? The level of depletion in mantle roots seems the tral buoyancy, required for shallow subduction and "stacking" differ enough from the present-day to engender a more neu-
Impacts, mega-tsunami, and other extraordinary claims

Ted P. Bunch, Northern Arizona University, Flagstaff, Arizona 86001, USA, allen7633@aol.com; James Kennett, University of California, Santa Barbara, California 93106-9630, USA, kennett@geol.ucsb.edu; Douglas K. Kennett, University of Oregon, Eugene, Oregon 97403, USA, dikenett@uoregon.edu

Pinter and Ishman (2008) claim that 14 markers reported by Firestone et al. (2007) in the Younger Dryas impact layer (YDB) are from the “constant noncatastrophic rain of micrometeorites” (p. 37). That hypothesis is unsupported.

1. Karner et al. (2003) reported accretion of extraterrestrial material equaling $2.5 \times 10^9$ g yr$^{-1}$, across 67 m.y.; YDB material, averaging $14.13 \times 10^{13}$ g yr$^{-1}$, equals 56,500 yr of accumulation.1

2. Rudnick and Gao (2003) measured global iridium concentrations of 0.022 ng g$^{-1}$. YDB iridium averaged 1.94 ng g$^{-1}$, or 88 times higher and undetectable outside that layer.1

3. At Blackwater Draw, New Mexico, Haynes et al. (1999) concluded that any break in YDB sedimentation lasted “no more than a decade” (p. 468), insufficient for micrometeorites to yield the concentration noted above.1

4. The authors claim that the 14 YDB markers require an impossible “Frankenstein” impactor (p. 37), yet overlook the K-T impact, where nine of 14 markers form significant peaks and five others are consistent with intense wildfires.1 Nanodiamonds, especially, are well-accepted as impact markers.

In Earth’s entire geological record, all other known strata that contain synchronous peaks in microspherules, iridium, nanodiamonds, and the other markers are widely considered to result from an extraterrestrial impact. We reject the authors’ conjectures and stand by our data.


REFERENCES CITED


Manuscript received 31 January 2008; accepted 1 February 2008.

There’s more online! Additional comments on the January GSA Today Groundwork article (v. 18, no. 1, p. 37–38) are online, along with Pinter and Ishman’s Reply. Go to www.geosociety.org/pubs/, click on “Comments & Replies” in the GSA Today column, and follow the links for Abbott et al. and Firestone and West.

Exhibitors are listed by category as registered as of press copy deadline.

ASA-CSSA-SSSA
California Analytical Instruments
International Plant Nutrition Institute
Landviser LLC
Spectrum Technologies

Computer Software
Agronomix Software Inc.
ESRI
GEON 2.0
GrailQuest Corp.
GSI Co. Ltd.
IVS 3D Inc.
PETROSYS

Energy Solutions

Gems/Minerals Dealers, Jewelry/Gifts
Cal Graeber
Crystals Unlimited
D A W Trading Co.
Finesilver Designs/Jewelry
Gems & Crystals Unlimited
IKON Mining & Exploration
Komodo Dragon
Nature’s Own
The Paleoclock Company

General Educational Products
Armfield
Brooks/Cole–Cengage Learning
Paleomap Project
ProQuest CSA
Ward’s Natural Science Est. LLC

Geographic Supplies and Related Equipment (including GIS)
Forestry Suppliers Inc.
Rite in the Rain

Geological Services (Exploration, Laboratories, Consulting, & others)
Activation Laboratories Ltd.
Baker Hughes
Beta Analytic Inc.
Crown Geochemistry Inc.
DOSECC
Environmental Isotope Laboratory
INEXS
Paleo-Data Inc.
Paradigm

Geophysical Services and Consulting
Resolve Geosciences Inc.
Subsurface Consultants & Associates LLC

Geological Society of America
GSA Coal Geology Division
GSA Engineering Geology Division
GSA Geoinformatics Division
GSA Geology & Society Division
GSA Geology and Public Policy Committee
GSA Geoscience Educator Division
GSA History of Geology Division & History of Earth Sciences Society
GSA Limnogeology Division
GSA Planetary Geology Division

Geological and Geophysical Instrumentation/Workstations
Advanced Geosciences Inc.
ASC Scientific
ASD Inc.
Australian Scientific Instruments Pty Ltd.
Camcra Instruments Inc.
Campbell Scientific Inc.
DeltaNu Inc.
EmCal Scientific Inc.
Gatan Inc.
Geophysical Survey Systems Inc.
GISCO
Hitachi High Technologies America Inc.
Horiba Instruments Inc.
In-Situ Inc.
IXRF Systems Inc.
Leica Microsystems Inc.
Los Gatos Research MALA
Meiji Techno America
New Wave Research
Optech Inc.
PANalytical Inc.
Rigaku Americas
Thermo Scientific
TreeRadar Inc.
Wescor

Geophysical Services and Consulting
eSeis Inc.

Government Agencies (Federal, State, Local, International)
Geoscience Laboratories
Minerals Management Service
National Mine Map Repository
National Park Service
National Park Service Soil Resources Inventory (SRI) Program
National Science Foundation
Office of Surface Mining
Oklahoma Geological Survey
Rocky Mountain Oilfield Testing Center
U.S. Bureau of Land Management
U.S. Geological Survey
USDA Forest Service
USDA Natural Resources Conservation Service

Laboratory Supplies and Related Equipment
CETAC Technologies
Convirion
Everest Interscience
Innov-X Systems
Phenotype Screening Corporation

Other
Agriculex Inc.
Agrotaín International
ALMACO
Apogee Instruments
Bio Chambers
Cambe Geological Services Inc.
CGGVeritas
CID Inc.
Columbia Trading Co.
Consortium for Ocean Leadership
Consortium of Universities for the Advancement of Hydrologic Science Inc. (CUAHSI)

CRC Press–Taylor & Francis Group LLC
Decagon Devices
Delta-T Devices
DGB Earth Sciences
Drilling Info Inc.
Dynamax
EarthScope
Elementar Americas
Environmental Growth Chambers
Fugro Multi Client Services Inc.
Fugro-Jason Inc.
Gemological Institute of America
GeoCare Benefits Insurance Programs
Geomodeling Corp.
Giddings Machine Co.
Gillison Variety Fab Inc.
Gravity Map Service
Gylling Data Management
Hach Environmental
Happy Feet Inc.
Holland Scientific Inc.
IHS Energy
Integrated Geophysics Corporation
IRIS Consortium
Irrometer Company
Juniper Systems Inc.
Leco Corp.
Li-Cor Biosciences
Mass Spec Solutions Inc.
Micro Strat Inc.
MIT
National Research Council of the National Academies
Neuralog
OI Analytical
Onset Computer Corporation
Opti-Sciences Inc.
PMS Instrument Company
PP Systems
Qubit Systems Inc.
Samuel Roberts Noble Foundation
Science Technology Resources
SeaBird Exploration
Seed Research Equipment Solutions
Seismic Micro Technology Inc.
SmartCrop™ by Accent Engineering Inc.
Soil Measurement Systems Inc.
Soilmoisture Equipment Corp.
Solinst Canada Ltd.

Exhibitors
HOUSTON 2008 JOINT ANNUAL MEETING

2008 JOINT MEETING

Exhibitors are listed by category as registered as of press copy deadline.
Exhibits Opening & Welcome Reception:
Sun., 5 Oct., 7–9 p.m.

Exhibit Hall Hours: Sun., 5 Oct. 7–9 p.m.;
Mon.–Tues., 6–7 Oct., 9 a.m.–6 p.m.;
Wed., 8 Oct., 9 a.m.–2 p.m.
The area around Houston offers unique opportunities to explore classic field locations and learn about ground-breaking research in the region. Plan on budgeting extra time for a field trip!

All trips begin and end at the George R. Brown Convention Center in Houston, unless otherwise indicated. Precise trip itineraries will be provided upon registration; you may also contact the field trip leaders directly. Participants are cautioned against scheduling any tight travel connections with the field trip return times, as those are estimates, and delays in the field may occur.

To register only for a field trip, you must pay a meeting nonregistrant fee (see the registration section) in addition to the field trip fee. This fee may be applied toward meeting registration if you decide to attend the meeting.

Trip fees include transportation during the trip; other services, such as meals and lodging, are noted with each trip by the following: B—breakfast, L—lunch, R—refreshments, D—dinner, ON—overnight lodging.

For detailed field trip descriptions and contact information, visit www.acsmeetings.org/programs/field-trips-and-tours/field/

Questions? Please contact Eric Nocerino, +1-303-357-1060, enocerino@geosociety.org.


POSTMEETING


Short Courses
HOUSTON 2008 JOINT ANNUAL MEETING

The following short courses, to be held immediately before and during the annual meeting, are open to everyone. If you would like to register just for a short course, you must pay a meeting nonregistrant fee (see the registration section) in addition to the course fee. This fee may be applied toward meeting registration if you decide to attend. Exception: GSA K–12 Teacher Members need only pay the short course fee if not attending the entire meeting.

Continuing Education Unit (CEU) Service: Most professional development courses and workshops offer CEUs. One CEU comprises 10 contact hours (contact hour = 60-minute classroom instructional session or its equivalent) of participation in an organized continuing education experience under responsible sponsorship, capable direction, and qualified instruction.

Early registration is recommended; standard registration (after 2 Sept.) is an additional US$30. Cancellation deadline: 19 September 2008. See www.acsmeetings.org/programs/short-courses/ or contact Jennifer Nocerino, jnocerino@geosociety.org, for additional information.

PROFESSIONAL COURSES


Estimates of groundwater recharge are required to accurately assess water resources and evaluate aquifer vulnerability to contamination. This course will review theory, assumptions, uncertainties, advantages, and limitations of different approaches for estimating recharge rates. We will discuss physical, tracer, and numerical modeling techniques based on surface water, unsaturated zone, and saturated zone data. Course content is aimed at practicing hydrologists and advanced hydrology students.


This one-day course is essential for every technical professional involved in exploration, production, and drilling for oil and gas. Basic geological building blocks are used as the foundation for pore pressure predictions. This course covers the essentials of geopressure compartmentalization in relation to pore pressure development with depth and emphasizes the differences between the geopressured and hydrodynamic systems. It is an introduction to definitions, models, measurements, predictions, calibrations, and appraisals of subsurface geopressure. The course also briefly discusses different geopressure case histories and their implications for exploration and exploitation.


The objective of the class is to teach geophysicists and geologists how to QC petrophysical data. To do this properly, they need to understand what the petrophysicist does (typical workflows used), problems that might be encountered, assumptions made, and how problems can be identified in a variety of QC plots. This will include calibration of logs, hole effects, tool failure, rock physics, etc. Participants should already have a basic understanding of well logs and their purpose. If you have any questions on class content, please e-mail etfisher@hess.com.

504. Seismic Amplitude Interpretation. Sat., 4 Oct., 8 a.m.–5 p.m. Cosponsored by GCAGS; Fred Hilterman, Geokinetics Inc. Limit: 30. Fee: US$220; includes lunch. CEU: 0.8.

A reservoir's composition is derived from seismic amplitude interpretation. This course introduces the rock-physics basics for reservoir characterization and catalogs rock properties to expected seismic signatures. Techniques for recognizing and quantifying hydrocarbons in different rock-property settings (Class 1-4) are presented and illustrated with numerous field examples. Various seismic amplitude attributes for distinguishing lithology and pore fluid are introduced. Rock-property and AVO modeling programs are supplied to each participant to assist in the seismic discrimination of lithology and pore-fluid.


Participants will be introduced to the use of GIS in geosciences and environmentally related applications through brief lectures, demonstrations, and hands-on computer exercises. Participants do not need experience with ArcGIS, but familiarity with Windows OS would be most helpful. A brief introduction to spatial concepts and GIS using ArcGIS ArcMap and Spatial and 3D Analyst extensions will follow with the creation of a project covering many analysis techniques (geoprocessing using Toolbox tools and ModelBuilder). Use of Geodatabase Model schema and resources for accessing data will be explored.


Seals are absolutely fundamental to hydrocarbon accumulations on many levels; they control migration, charge volumes, the lateral and vertical distribution of hydrocarbons in a basin, percent fill of a reservoir; and the flow of hydrocarbons during production. The economic success or failure of a project is strongly dependent on proper seal risking. Despite that, they are the least-studied element of the petroleum system. Participants in this course will learn analytical approaches for seal analyses, controls on seal character, seal development and burial history, seal risk analysis, sequence stratigraphic framework of seals, and predictive models for estimating top and fault seal capacity.


Many licensure boards require all registered geologists to meet continuing education requirements. One of those requirements is a minimum of one professional development hour per renewal period in the area of professional ethics, roles, and responsibilities. This one-hour program will start with a lecture...
that covers situations in which geoscientists will be challenged to select the most ethical course of action. Some situations are easy, but as illustrated in this course, some are not. A question-and-answer session will follow the main lecture, and course participants will debate various alternatives to situations they themselves have encountered. This course is enlightening and thought-provoking.

508. The WRB (World Reference Base for Soil Resources)—An International Soil Classification System. Sun., 5 Oct., 8:30 a.m.–12:30 p.m. Cosponsored by SS Division of SSSA. Peter Schad, Technische Univ. München; Erika Micheli, Szent Istvan Univ. Limit: 50. Fee: US$170. CEU: 0.4.

WRB is an international soil classification system officially used by the International Union of Soil Sciences for communication among soil scientists all over the world. The workshop will discuss the principles, the architecture, and the rules for classification. The 32 Reference Soil Groups comprising the first hierarchical level will be introduced, and the second level (qualifier level) will be explained. Benchmark soils from the United States and other countries will be used as training examples and to show correlation possibilities between WRB and soil taxonomy. The target audience includes university teachers who want to include WRB in their curriculum, other professionals, and graduate students.


This course is led by John Doherty, author of the open-source inverse code, PEST, and Matt Tonkin (SSP&A). The course includes lectures presenting theory and practical applications together with labs enabling participants to apply PEST. Course CDs contain lecture, lab, and reference materials, plus PEST and associated software. Topics include parameter estimation theory, the use of pilot points, mathematical regularization, the calibration solution and null spaces, and linear and non-linear predictive error analysis, including calibration-constrained Monte Carlo. Attendees benefiting from this course range from experienced modelers to non-modelers who make decisions on the basis of models.

510. Brittle Deformation of Crustal Rocks: Insights from Experimentation and Microstructural Studies. Thurs., 5–9 p.m.; Fri., 8 a.m.–5 p.m., Sat., 9 a.m.–5 p.m., 2–4 Oct. Frederick Chester, Texas A&M; Dave Wiltschko, Texas A&M; Judith Chester, Texas A&M; Steve Laubach, Univ. of Texas. Limit: 30. Fee: US$150: includes banquet dinner and lunch; course to be held at Texas A&M in College Station, Texas; fee does not include transportation (two-hour drive or 30-minute flight from Houston; shuttle service available). CEU: 1.9.

This course covers the brittle processes of deformation and recovery in granular and clastic rocks over the range of conditions from near-surface to deep crust, and will include lectures from multiple speakers with ample time for group discussion, hands-on microstructural observations and laboratory activities, tour of a rock deformation laboratory, demonstration of rock deformation experiments, sharing of education and research products, and socializing. Geared towards researchers, graduate students, and faculty.


Come learn how to use 3-D visualization in the classroom to broaden your students’ understanding of complex depositional systems and structural environments. The first half of the course will teach the basic operation of 3-D visualization techniques. In the second half, you will have the opportunity to apply them to 3-D datasets from a variety of depositional and structural settings around the world. Examples will include 3-D seismic reflection and ground penetrating radar data.

GSA Presidential Address and Awards Ceremony

Sat., 4 Oct., 7–9 p.m. George R. Brown Convention Center, General Assembly Theater

A reception will immediately follow the ceremony.

Join us Saturday evening when President Judith Totman Parrish gives her Presidential Address and presents the 2008 awards and medals. Recipients of the Penrose Medal, the Arthur L. Day Medal, the Young Scientist Award (Donath Medal), the President’s Medal of The Geological Society of America, the GSA Public Service Award, the GSA Distinguished Service Award, the Bromery Award for the Minorities, and the American Geological Institute (AGI) Medal in Memory of Ian Campbell will be honored. The newly elected Honorary Fellows, the Subaru Outstanding Woman in Science Awardee, GSA Divisions Awardees, and the newly elected GSA Fellows will also be acknowledged.
512. **Sequence Stratigraphy for Graduate Students.** Fri.—Sat., 3–4 Oct., 8 a.m.—5 p.m. Cosponsored by ExxonMobil BP. Art Donovan, BP Upstream Technology Directorate; K.M. Campion, ExxonMobil Upstream Research. Limit: 55. No fee. Preregistration required. For information or to register, please e-mail art.donovan@bp.com. CEU: 1.6.

This free short course is designed to teach graduate students the principles, concepts, and methods of sequence stratigraphy. Sequence stratigraphy is a methodology that uses stratal surfaces to subdivide the stratigraphic record. This methodology allows the identification of coeval facies, documents the time-transgressive nature of classic lithostratigraphic units, and provides geoscientists with an additional way to analyze and subdivide the stratigraphic record. Using exercises that utilize outcrop, core, well-log, and seismic data, the course provides a hands-on experience for learning sequence stratigraphy. The exercises include classic case studies from which many sequence stratigraphic concepts were originally developed.


In this workshop, participants will learn qualitative education data collection and analysis methods used in geoscience education research. Case studies, demonstrations, and hands-on activities will be used to introduce participants to developing qualitative research questions, collecting qualitative data (e.g., interviews), and analyzing qualitative data (e.g., coding). This workshop is geared for students, college and K–12 educators, and researchers who are engaged in or who plan to be engaged in geoscience education research. This course can be taken alone or in conjunction with the short course “Education Research II: Conducting Quantitative Geoscience Education Research.”

514. **Hands-on Tools for Earth Science Inquiry: The Learning with Data Workshop.** Sat., 4 Oct., 8 a.m.—noon. William Prothero, Jr., Univ. of California at Santa Barbara (emeritus); Sabina Thomas, Baldwin Wallace College. Limit: 30. Fee: US$65. CEU: 0.4.

Increase student learning in general education earth science courses by implementing data exploration and writing activities with the “Learning with Data Workshop” (LWD). LWD is a comprehensive resource intended to support learning about Earth using real data. It allows learners to access earth data, create and annotate data display images, and incorporate them into writing activities, which are also included in the package. Workshop participants will gain familiarity with the software content, learn how to use it to support effective inquiry and writing activities, and learn how to customize the assignments that are included with LWD. For more information, go to http://earthdata.net/lwd/.


The purpose of this workshop is to enable participants to develop a course of their own on Darwin. Workshop leader Leo Laporte taught a course on Darwin for many years at the University of California at Santa Cruz. He has taught this workshop previously and has developed a Web site of resources for a Darwin course. 2009 will be the 150th anniversary of the publication of On the Origin of Species and also the 200th anniversary of Darwin’s birth. The GSA History of Geology Division is pleased to sponsor this timely workshop. Contact Leo Laporte, laporte@ucsc.edu, with questions.

516. **Using Authentic NASA Earth and Planetary Science Data for Inquiry in Courses for Future Science Teachers.** Sat., 4 Oct., 8 a.m.—noon. Cosponsored by NASA. Tim Slater, Univ. of Wyoming; Rick Pomero, Univ. of California at Davis; Stephanie Shipp, Lunar Planetary Institute; Stephanie Slater, Univ. of Wyoming; Lin Chambers, NASA. Limit: 40. Fee: US$14. CEU: 0.4.

This participatory workshop for college and university faculty provides participants with strategies, classroom-ready tools, and instructional materials designed for use with future science teachers in undergraduate geoscience courses and courses on science teaching methods. It will cover how to effectively conduct scientific inquiry investigations using NASA earth and planetary science data. Participants are encouraged, but not required, to bring their own laptops, equipped with MS Office and a CD-ROM drive.


This short course will provide an introduction to the theory, processing, and geologic applications associated with multi- and hyperspectral remote sensing. Multispectral data from a sensor such as ASTER can be used to map iron-bearing minerals, carbonates, phyllosilicate, and other silicate minerals. Hyperspectral data has higher spectral resolution and can be used to identify many minerals based on characteristic absorption features associated with these minerals. These data can be used for a number of geologic applications, including mineral and lithologic mapping, sedimentary facies mapping, mineral exploration, abandoned mine land assessment, and soils mapping.

518. **Starting out in Undergraduate Research and Education: A Professional Development Workshop for Young Faculty.** Sat., 4 Oct., 8 a.m.—5 p.m. Cosponsored by Council on Undergraduate Research; National Association of Geoscience Teachers. Jeffrey Ryan, Univ. of South Florida; Lydia Fox, Council on Undergraduate Research; Jill Singer, Council on Undergraduate Research. Limit: 30. Fee: US$65; includes lunch. CEU: 0.8.

This day-long workshop is targeted at early-career faculty and postdoctoral scientists or graduate students seeking an academic career. Topics include resources for generating exemplary geoscience courses, methods for integrating research practices into the classroom, and effective approaches to mentoring undergraduate researchers toward their best benefit and that of their faculty mentors. Based on the demographics of our participants, we may also include a section on how to get a job at an academic institution (primarily undergraduate institution or regional university). Facilitators are all officers in the Council on Undergraduate Research or the National Association of Geoscience Teachers.

519. **Teaching Petrology and Structural Geology in the 21st Century.** Sat., 4 Oct., 8 a.m.—5 p.m. Cosponsored by On the Cutting Edge; GSA Structural Geology & Tectonics Division; GSA Geoscience Education Division. Barbara Tewksbury, Hamilton College; Yvette D. Kuiper, Boston College; Jeffrey Ryan, Univ. of South Florida. Limit: 50. Fee: US$45; includes lunch. CEU: 0.8.

This workshop is a follow-on to the highly successful 2003 and 2004 "On the Cutting Edge" workshops on "Teaching Petrology and Teaching Structural Geology in the 21st Century." We seek participants who can share innovative and effective classroom, lab, field, or GIS activities or who have ways to integrate concepts from these two disciplines into courses taught in other areas of the undergraduate curriculum. This workshop will also provide an opportunity for discussing issues related to teaching the two disciplines. Participants will contribute their activities to the Cutting Edge online resource collections for teaching petrology and structural geology (http://serc.carleton.edu/NAGTWorkshops/).

520. **Beyond the Content: Teaching Scientific and Citizenship Literacities in the Geosciences.** Sat., 4 Oct., 9 a.m.—5 p.m. Erin Campbell-Stone, Univ. of Wyoming; James Myers, Univ. of Wyoming. Limit: 30. Fee: US$47. CEU: 0.7.

A primary goal of many geoscience courses is to provide students with the scientific knowledge necessary to make informed decisions about societal issues, but often students are not equipped with the scientific literacies necessary to convert facts into understanding, nor are they able to make connections between content and society. Course leaders will share their techniques for...
assessing students and courses (introductory to junior-level undergraduate courses) with regard to scientific and citizenship literacies, and they will provide tools for adding a literacy component to participants' existing courses.


This workshop addresses topics related to building a case for tenure and preparing a tenure package. Participants will examine excerpts from tenure packages from a range of academic institutions and will discuss successful tenure packages and strategies used to make persuasive arguments. They will also review teaching materials (including from their own teaching) and discuss how they could be used as evidence of excellent teaching. We will also discuss other topics related to the tenure process. Participants should be in a tenure-track (or equivalent) position in a two- or four-year college or university at the time of the workshop.

522. The Use of GPS, LiDAR, and InSAR Data to Learn about Plate Tectonics, Crustal Deformation, Isostasy, and Ice Flow: A Short Course for Faculty at Two- and Four-Year Institutions. Sat., 4 Oct., 9 a.m.–5 p.m. Cosponsored by UNAVCO. Helmut Mayer, UNAVCO; Susan C. Eriksson, UNAVCO; Shelley Olds, UNAVCO. Limit: 20. Fee: US$31; includes continental breakfast and refreshments. CEU: 0.7.

This course is geared toward faculty at two- and four-year colleges who teach earth science or a science course in which plate tectonics is a topic. Participants will be introduced to place-based, data-rich educational materials about GPS and plate tectonics to use in their classrooms, receive an introduction to high-precision GPS, and have the opportunity to discuss pedagogical strategies for classroom implementation. Anticipated topics include slow earthquakes in Cascadia, volcano deformation, isostatic rebound, and ice flow. Applications of new technologies, such as LiDAR and InSAR, will be introduced. Knowledge of GPS is not required.


The Geoscience Concept Inventory, or GCI, is a valid and reliable assessment tool designed for entry-level college earth science courses. Although used widely, the GCI currently consists of only 69 validated questions and covers only a narrow range of topics relevant to the earth sciences. The geoscience community can help build assessment tools relevant to their own courses through participation in the new GCI initiative to generate a community-developed bank of GCI questions. Participants in this workshop will learn techniques for writing multiple-choice questions and will receive training in qualitative data analysis for concept inventory development.


This participatory workshop for college and university geoscience faculty provides an overview and introduction to the motivations, strategies, methodology, and publication routes for improving geoscience education through conducting science education research in their own classrooms. Participants will evaluate the value of various education research questions, identify strengths and weaknesses of several research design methodologies, learn how to obtain Institutional Review Board approval to conduct education research on human subjects, and become more aware of how education research articles are created for publication in journals such as the Journal of Geoscience Education.


This interactive, activity-based course serves as an introduction to quantitative education research methods. It is designed for geoscience faculty or students who are or will be conducting quantitative education studies. Topics will include developing quantitative education research questions, designing a quantitative study (e.g., selecting appropriate statistical tests), collecting quantitative data (e.g., surveys), and analyzing education data using statistical tests (e.g., ANOVA). This course can be taken alone or in conjunction with the short course “Education Research I: Conducting Qualitative Geoscience Education Research.”
526. Visualization in Geoscience Education: The Power of Immersive Environments
Sat., 4 Oct., 1–5 p.m. Cosponsored by Experiential Learning in Environmental and Natural Sciences Centre for Excellence in Teaching and Learning (EL CETL); GSA Geoscience Education Division; Higher Education Academy Subject Centre for Geography, Earth & Environmental Sciences. Alison Stokes, EL CETL; Helen King, Independent Consultant. Limit: 25. Fee: US$60. CEU: 0.4.

This course will introduce participants to immersive “dome” technology and demonstrate its potential for geoscience education and outreach. Whilst many virtual environments act as tools in the preparation for fieldwork, immersive environments are finding wider and more innovative applications, such as visualizing complex data sets and processes that act on scales in time and space that cannot be observed directly. The pedagogic potential of dome environments will be explored through a combination of formal presentation, participant discussion and activities, and demonstrations of immersive technology within a portable dome environment.


This workshop is designed for upper-level undergraduates and graduate students who are examining their options upon graduation. We will discuss job-search techniques in the private sector, including consulting, industry, and government. Also to be presented are opportunities for geologists in oil and gas, exploration and extraction of metallic and non-metallic minerals, environmental management and water supply, state and federal agencies, and academic teaching and research.

528. Introduction to the Petroleum Geology of Deepwater Settings.
Sat.–Sun., 4–5 Oct., 8 a.m.–5 p.m. Cosponsored by GCAGS. Paul Weimer, Univ. of Colorado. Limit: 40. Fee: US$400; includes lunch. CEU: 1.6.

The purpose of this course is to provide a broad overview of the petroleum systems of deepwater settings for the working geoscientist. The salient and important points to be covered can be integrated into a geoscientist’s daily work flow. Topics include a global overview of deepwater exploration and production; sequence stratigraphic setting of deepwater systems; sedimentary-gravity flows and their processes; deepwater-reservoir elements (channels, levee-overbank, sheet sandstones; mass-transport deposits, hybrid-type); interpretation pitfalls; biostratigraphy; reservoir quality; traps; and petroleum systems. The overview will cover ~70–75% of the information. Several exercises will be included in the course, and a book will be provided (AAPG Studies in Geology no. 57).

529. Teaching Field Methods in Geology Using Rugged Tablet Computers, GPS, and Digital Data. Sun., 5 Oct., 8 a.m.–5 p.m. This course is made possible in part by a generous donation from HP. Mark Manone, Northern Arizona Univ.; Peter Knoop, Univ. of Michigan. Limit: 20. Fee: US$80. CEU: 0.8.

Field geology is benefiting greatly from digital technologies of all kinds. In particular, the use of ruggedized tablet computers with integrated GPS, GIS, data management, and note-taking software presents a fundamentally new way to map and collect data in the field. This combination of integrated technologies offers exciting avenues for teaching field geology and geologic mapping. This workshop will expose field instructors to the opportunity to learn all aspects of working with these integrated technologies, including hardware, software, data, logistics, and future trends. Workshop participants will be involved with hands-on applications throughout the entire session.

Sun., 5 Oct., 1–5 p.m. Cosponsored by GSA Geoscience Education Division. Karen Kortz, Community College of Rhode Island and Univ. of Rhode Island; Jessica Smay, San José City College. Limit: 50. Fee: US$93. CEU: 0.4.

Participants will learn about lecture tutorials and other classroom techniques designed to make lectures more interactive. Lecture tutorials are short, interactive workshops students complete in class after a brief lecture, designed to increase learning and decrease misconceptions. Each teaching technique will be demonstrated, providing participants practice with classroom-ready examples and guidance as they create their own examples. Participants will receive a book of lecture tutorials and examples of other interactive techniques with references for more. This workshop is geared toward faculty at two- or four-year institutions or graduate students who will teach introductory geoscience courses.

531. Fundamentals of Seismic Structural Analysis and Hydrocarbon Entrapment Analysis for Graduate Students.
Thurs.–Fri., 9–10 Oct., 9 a.m.–5 p.m. Cosponsored by ExxonMobil; Conoco Phillips; GSA Structural Geology and Tectonics Division. Peter Vrolijk, ExxonMobil Upstream Research Corp.; Peter Hennings, Conoco-Phillips; Franco Corona, ExxonMobil; Steve Davis, ExxonMobil. Limit: 30. No fee. Preregistration required. For information or to register, please e-mail peter.vrolijk@exxonmobil.com. CEU: 1.4.

The purpose of this course is to introduce geoscience graduate students to general concepts of seismic structural interpretation and the role of structural interpretation in evaluating subsurface petroleum traps. The course will be taught in ConocoPhillips and ExxonMobil facilities using a combination of lecture materials and hands-on exercises. Day 1 of the course will introduce students to the fundamentals of seismic interpretation of structural systems in exploration and production. Day 2 will focus on the application of structural interpretations to the problems of petroleum trapping and the interaction of multiphase fluids with geologic structures and rocks in the subsurface.

Thurs.–Fri., 9–10 Oct., 9 a.m.–5 p.m. Cosponsored by ExxonMobil Exploration Corp. Lori L. Summa, ExxonMobil Exploration; Bob Stewart, ExxonMobil Exploration. Limit: 30. No fee. Preregistration required. For information or to register, please e-mail lori.l.summa@exxonmobil.com. CEU: 1.4.

This course will explore concepts, methods, and tools of petroleum geoscience used on a day-to-day basis in the energy industry. We focus on how we make decisions with limited information, evaluate risk vs. uncertainty, and maximize value from integrated teams. Day 1 reviews fundamental stratigraphic and structural concepts. Day 2 is an applied problem in basin exploration. Students will make “play” maps, bid on prospective acreage, and analyze individual prospects within that acreage. Throughout the course we stress integration across disciplines and scales, focusing on the interaction and expression of basin formation, fill, and evolution processes from regional to prospect scales.

Short Courses continued on p. 22.
Pause in the bustle of the Annual Meeting to visit the Hall of Fame and acknowledge your well-deserving and hard-working colleagues, mentors, students—and maybe even see a banner honoring you!

This year, the Hall of Fame honors:

- Current and past GSA geoscience award winners;
- Current and past recipients of the AGI Medal in Memory of Ian Campbell;
- Current and past awardees from GSA’s Divisions;
- GSA Fellows and Honorary Fellows;
- 50-year and 25-year GSA Members;
- Allied and Associated Society award recipients; and
- Top-ranked graduate student research grant recipients.

RESERVE YOUR SPACE NOW!

Even if you missed the 20 May space request deadline, it isn’t too late to register your event! Please go to the space request form and register your event today. All meeting space assignments will be made on a first-come, first-served basis, and we will make every effort to accommodate your requests. Link directly to the page at rock.geosociety.org/space_request, or follow these easy steps to ensure your spot in the lineup:

1. Go to www.acsmeetings.org/2008/;
2. Click on “Program” then “Events”;
3. Click on “Plan Your Event”;
4. Go to the space request form and complete it online.

Alumni Receptions

In the spirit of the Joint Annual Meeting, consider hosting a joint alumni reception with your school’s other departments that are going to be in Houston! Contact your counterparts in other departments to plan the alumni reception for your school (earth sciences, soil science, geology, plant sciences, and agronomy). Almost all alumni receptions occur on Monday night, 6 October.

Don’t wait until the last minute.
K–12 Teacher Courses


This course covers the full scope of earth sciences for third–eighth grade teachers, and the comprehensive manual provided will enable full or partial incorporation into their curriculum. Build confidence with (1) background information, (2) vocabulary, (3) project information, (4) hands-on projects, (5) gifted and talented, and (6) cross-curricular ideas. Includes Earth’s structure, rock cycle, igneous, sedimentary, and metamorphic rocks, soil and sand analysis, erosion and deposition, caves, fossils, plate tectonics, geologic history, relative and absolute age dating, minerals, mining, fossil fuels, and landform forces. Teachers receive 0.8 CEU, a manual, labeled rock and mineral samples, the USGS Time and Terrain Tapestry map of the United States, Texas Assessment of Knowledge and Skills correlation charts, and a “Hunt for Fossil Fuels” oil exploration game.

534. Discovering Plate Boundaries for Middle and High School Teachers. Fri., 3 Oct., noon–5 p.m. Cosponsored by Houston Geological Society; Region 4 Texas Education Service Center. Dale Sawyer, Rice University. Limit: 40. No fee; lunch provided. CEU: 0.4.

Discovering plate boundaries is a data-rich classroom exercise that helps middle and high school students discover plate boundary processes. The exercise is built around four global data maps: (1) earthquake location and depth, (2) location of recent volcanic activity, (3) seafloor age, and (4) topography and bathymetry. The exercise is based on the “jigsaw” concept, mixing students into different groups during the exercise, and takes about three hours. Participants will experience the exercise from both the student’s and teacher’s perspectives and will take away a reusable kit for teaching.

The Geological Society of America

2008* Houston, Texas, USA (5–9 October)

FUTURE GSA ANNUAL MEETINGS

2009 Portland, Oregon, USA (18–21 October)
2010 Denver, Colorado, USA (31 Oct.–3 Nov.)
2011 Minneapolis, Minnesota, USA (9–12 October)

*Joint Meeting with the American Society of Agronomy–Crop Science Society of America–Soil Science Society of America and the Gulf Coast Association of Geological Societies with the Gulf Coast Section SEPM; hosted by the Houston Geological Society.

ALLIED & ASSOCIATED SOCIETY SHORT COURSES

535. An Introduction to Petroleum Geology for Students. Fri., 3 Oct., 8 a.m.–5 p.m. Cosponsored by American Association of Petroleum Geologists. Stephen L. Bend, Univ. of Regina. Limit: 50. Fee: US$350; includes lunch and refreshments. CEU: 0.7. For information or to register, e-mail dboonstra@aapg.org.

This course is for undergraduate and graduate students who are curious about oil and gas exploration and possible careers in the industry. The emphasis is on the applied side, to demonstrate the practicality of their geological knowledge and to show the multidimensional aspect of the industry in order to convey a sense of the diverse career opportunities for geoscientists. Topics include the geology of oil and gas, formation and entrapment of oil and gas, the economics and geology of exploration, how geoscientists explore for oil and gas, and how oil and gas is produced. No course notes will be provided, but attendees will be given a copy of the American Association of Petroleum Geologist’s e-text on petroleum geology.


Karst research and management has been predominantly based on the premise that karst aquifers are developed epigenically (by descending groundwater). While many are, recent studies show that many and major karst aquifers have hypogenic (ascending groundwater) origins. Major differences occur between these modes that affect groundwater flow patterns, modeling, chemistry, aquifer evolution, cave morphology, land management practices, and the occurrence of economic mineral deposits. Course participants will learn how epigenic and hypogenic systems work, how to identify them, and how to adjust research and management strategies to be suitable for each.

537. Paleontological Society Centennial Short Course—From Evolution to Geobiology: Research Questions Driving Paleontology at the Start of a New Century. Sat., 4 Oct., 8 a.m.–5 p.m. Cosponsored by Paleontological Society. Richard K. Bambach, Smithsonian National Museum of Natural History; Patricia H. Kelley, Univ. of North Carolina–Wilmington. No limit; no fee. For more information, e-mail kelleyp@uncw.edu or bambahc@si.edu.

At the centennial of the Paleontological Society, our program surveys the broad range of research topics that hold promise for the future in our profession. Rather than asking the “usual suspects” to pontificate on what we already know interests them, we have invited a group of young to mid-career leaders to address the spectrum of research questions that are motivating their research. New approaches to issues ranging across all of paleontology, each with new results, are on the program. Geobiology, evolution, vertebrate paleontology, systematics, isotopes studies, paleobiogeography, paleoecology, paleobotany, and more are represented. This will be a day to connect with the “new” multidisciplinary paleontology. Join us and expand your horizons.

538. Introduction to Petroleum Geology for Faculty. Sat.–Sun., 4–5 Oct., 8 a.m.–5 p.m. Cosponsored by American Association of Petroleum Geologists. Stephen L. Bend, Univ. of Regina. Limit: 50. Fee: US$580; includes lunch and refreshments each day. CEU: 1.5. For information or to register, e-mail dboonstra@aapg.org.

This course is for university and college professors and instructors, with the goal to provide course material to those with limited resources and experience in petroleum geology, and to provide teaching strategems to help increase professional competency in the subject matter. Topics include overviews of the formation and accumulation of oil and gas, the business of exploration, the exploration process/making a play, drilling and production, and the use and application of petrophysical logs. No course notes are provided, but attendees will receive a copy of the American Association of Petroleum Geologist’s e-text on petroleum geology, as well as copies of exercises used in class.
Teacher Forum: Evolution in the Classroom
Sat., 4 Oct., 1–4:30 p.m., location and further details TBD.
Join GSA for an afternoon with experts in the field of evolution. The forum will cover the latest research and provide activities and answers to your questions about the challenges of teaching evolution. Teachers will also receive free evolution resources.

Geoscience Social Educators' Reception
Sat., 4 Oct., 5–7 p.m., location TBD.
Join other educators in a relaxing forum for socializing, sharing ideas, and meeting other geoscience community members interested in education. Come and meet the GSA Education & Outreach staff. Appetizers and cash bar provided.

Public Forum: Understanding Evolution
Tues., 7 Oct., 7–9 p.m., location TBD.
Everyone is invited to hear the latest evidence and ask questions about the theory of evolution and the importance of keeping it in our classrooms.

FIELD TRIP

418. Texas Coastal Systems: K–12 Teachers Trip to Galveston Island and the Brazos River. Sun., 5 Oct. Cosponsored by Houston Geological Society; Region 4 Texas Education Service. Alison Henning, Rice University, Houston, Tex., +1-713-446-6417, ahenning@rice.edu. FREE; includes lunch.

SHORT COURSES

See descriptions on p. 16–22.


534. Discovering Plate Boundaries for Middle and High School Teachers. Fri., 3 Oct., noon–5 p.m. Cosponsored by Houston Geological Society; Region 4 Texas Education Service Center. Dale Sawyer, Rice University, Houston, Tex. Limit: 40. No fee; lunch provided. CEU: 0.4.
Looking for QUALIFIED CANDIDATES?

At our upcoming joint annual meeting in Houston on 5–9 Oct. 2008, GSA's Employment Service Center will team up with the Soil Science Society of America–American Society of Agronomy–Crop Science Society of America's Career Placement Center to offer extraordinary opportunities for job seekers and employers.

Both centers will be in the same location and served by one joint registration area. However, each center will manage its own interview schedules, résumé databases, and job postings. As with previous annual meetings, job seekers and employers will continue to receive the same high quality of service. Please join us and take advantage of this wonderful opportunity.

Sign up for either one and reap the benefits of both!

For GSA's center, go to www.geosociety.org/Employment_Service/.

For the Soil Science Society of America–American Society of Agronomy–Crop Science Society of America's center, go to www.careerplacement.org/.

There's more...

The American Association of Petroleum Geologists Student Expo, 8–9 October 2008, coincides with our meeting.

Go to http://studentexpo.info/ for details.
Student Travel Grants
HOUSTON 2008 JOINT ANNUAL MEETING

Application deadline: 2 September 2008

Three separate grants are available to GSA Student Members this year. Online applications will be available during the registration period, which begins in early June. Watch www.geosociety.org/meetings/2008/travelgrants.htm for the link to the travel grant form.

Applying for a travel grant does not register you for the meeting.

You must register for the meeting (www.acsmeetings.org/registrations/) BEFORE you can apply for a travel grant.

Students may apply for multiple grants but may only receive one. Notification of grant status will be made by e-mail, and those receiving grants must pick up their checks in person (with photo ID) in Houston.

1. GSA Student Travel Grant for Minorities, Women, and Persons with Disabilities

The GSA Minorities and Women in the Geosciences Committee and the GSA Foundation announce the availability of student travel grant funds for one or more eligible students to attend the Joint Annual Meeting. The primary goal of this grant is to encourage the participation of women, minorities, and persons with disabilities in the geosciences at national meetings. Students will receive GSA membership for 2009 and an average cash award of US$500 to be used for roundtrip airfare, hotel accommodations, meeting registration, and/or meals.

Eligibility Requirements:

• Full-time student enrolled in an accredited university or college for the fall semester 2008 and majoring in geology, earth science, or a related field.
• U.S. citizenship, or permanent residency, with a valid social security number.
• Preference will be given to students presenting papers/posters either as primary or secondary authors.
• Undergraduate and graduate students may apply.
• Must be a GSA Student Member at the time of application.
• Awardees are expected to attend the entire meeting and to participate in GeoScience Day (a geological field trip for middle and/or high school students).

Please apply online at www.geosociety.org/meetings/2008/travelgrants.htm. A paper form (PDF format) will also be available if you cannot use the online application. Contact GSA at +1-303-357-1000 if you have any questions.

GSA meetings. For Section grant eligibility requirements, please visit the Section Web sites listed below or contact the Section secretary directly.

North-Central: www.geosociety.org/grants/negrant.htm
South-Central: www.geosociety.org/sectdiv/south/index.htm#travel
Northeastern: www.geosociety.org/grants/negrant.htm
Southeastern: core.ecu.edu/geology/neal/seg/sa/travel.html

The Rocky Mountain and Cordilleran Sections offer student travel grants for their regional Section Meetings but not for the Joint Annual Meeting.

3. Joint Meeting Student Travel Fund

This grant is for any student member of the participating organizations in the 2008 Joint Annual Meeting. More information, including eligibility requirements, is available in the STUDENTS section on the main meeting Web site: www.acsmeetings.org/students/travel-grants/.

2. GSA Section Travel Grants

The GSA Foundation has made US$4,500 in grants available to each of the six GSA Sections. The money, when combined with equal funds from the Sections, is used to help GSA Student Members (grad. & undergrad.) travel to GSA meetings. For Section grant eligibility requirements, please visit the Section Web sites listed below or contact the Section secretary directly.

North-Central: www.geosociety.org/grants/negrant.htm
South-Central: www.geosociety.org/sectdiv/south/index.htm#travel
Northeastern: www.geosociety.org/grants/negrant.htm
Southeastern: core.ecu.edu/geology/neal/seg/sa/travel.html

Association For Women Geoscientists

Join us for breakfast at GSA in Houston!

office@awg.org www.awg.org
Guest Program

HOUSTON 2008 JOINT ANNUAL MEETING

Guest registration is open to individuals accompanying a significant other who is registered for the Joint Annual Meeting as a professional or student. Individuals whose professional interests are related to geoscience, soil, agronomic, crop, or environmental sciences do not qualify for guest registration. As a registered guest, you’ll receive a special gift and are welcome to attend your companion’s technical session(s). You will also have admittance to the Exhibit Hall and the Guest Hospitality Suite. In addition, you will have the opportunity to sign up for special tours and professional field trips (additional fees apply).

Guest Hospitality Suite Hours
Sun.–Wed., 5–8 Oct., 8 a.m.–5:30 p.m.
Thurs., 9 Oct., 8 a.m.–noon

The Guest Hospitality Suite includes complimentary seminars, light food and beverages throughout the day, a gift, and the Presidents’ guest breakfast, and will be staffed by a hostess who can assist you with questions regarding restaurants, activities, and attractions, as well as offer general information about Houston.

Create Your Own Excursion with a Houstonian—Contact Houston Greeters
Houston Greeters is a free service that offers a unique look at Houston through the eyes and hearts of its residents. Local volunteers host individuals for a two- to four-hour visit to explore a local attraction or cultural destination. Free day passes on METRORail are available to visitors when engaged in a Greeter activity. Both visitor and Greeter bear any individual costs (for admission fees, etc.). Services are an agreement between each individual and the Houston Greeters. The 2008 Joint Meeting societies assume no responsibility for the services rendered. Register online at www.houstongreeters.org or by calling +1-713-473-3837. For best results, plan your excursion one or two months in advance.

Tour Space Center Houston—Book Directly with Houston Tours
Houston Tours offers daily roundtrips to Space Center Houston from most downtown hotels. Depart your hotel ~9:30 a.m. and return ~5 p.m. The fee for transportation and admission to Space Center Houston is US$60 for adults and US$30 for children 4–11 (children under 4 are free). Purchase your own lunch at the center for ~$11. Services are an agreement between each individual and Houston Tours. The 2008 Joint Annual Meeting societies assume no responsibility for services rendered. Call Houston Tours at +1-713-988-5900 for additional information or to make your reservations.

DESTINATION TOURS

All Annual Meeting attendees and guests are welcome to register for the following tours. The additional cost of formal guest tours covers professional tour guide fees, roundtrip transportation, admission fees, occasionally meals, and gratuities. Tours may be canceled if minimum attendance is not met, so please register early!

Destination tours will depart from the east lobby of the Hilton Americas–Houston Hotel. Plan to arrive at the departure location 15–30 minutes before the scheduled departure time to ensure that you don’t miss the bus.

SUNDAY, 5 OCTOBER
101. Motorcoach Orientation Tour: Downtown Houston and Gateway to the Museum District. 10 a.m.–noon. Cost: US$28. Min.: 20. Learn about Houston’s history and culture as you drive from Discovery Park to Sam Houston Park, from the Historic District to Buffalo Bayou, and from the Art Warehouses to City Hall. Locate restaurants, the theater district, and learn to negotiate METRORail.

MONDAY, 6 OCTOBER
102. Up, Down, and All Around—Downtown Walking Tour. 10 a.m.–12:30 p.m. Cost: US$16. Min.: 20. Below the nation’s 4th largest city is another “city”—underground downtown. Explore the tunnel system, then travel to the tallest building in Texas for a panoramic view. Continue with a tour of Houston’s diverse downtown.


TUESDAY, 7 OCTOBER
104. Religious Diversity in Multi-Cultural Houston—Hindu & Buddhist Temples, Islamic Mosque. 8 a.m.–4 p.m. Cost: US$68; lunch not included. Min.: 20. Did you know that Houston has 72 international consulates? Explore this rich diversity with visits to the BAPS Shri Swaminarayan Mandir (Hindu Temple), the Chung Mei Buddhist Temple, and the Islamic Mosque downtown. We will stop for lunch at Fadi’s Mediterranean Grill. Dress codes and other regulations apply.

105. Bayou Bend Collection and Gardens—Plus the Grand Homes of River Oaks. 1–4:30 p.m. Cost: US$53. Min.: 20. See the mansions of River Oaks, pass by the “Terms of Endearment” house, and tour the grand home and gardens of Bayou Bend, the estate of Miss Ima Hogg.

WEDNESDAY, 8 OCTOBER
106. Art Tour Extraordinaire—Rice University Gallery and the Menil Complex. 1–5 p.m. Cost: US$40. Min.: 20. We will view exhibits at the Rice University Gallery, the Menil Museum, the Rothko Chapel, Byzantine Fresco Chapel, Cy Twombly Gallery, and Richmond Hall. Within walking distance are the Watercolor Art Society—Houston Gallery, the Houston Center for Photography, and Café Artisté.

107. Galveston Tour—Ocean Star, The Strand, and Haak Vineyards. 9 a.m.–5 p.m. Cost: US$70; lunch not included. Min.: 20. Visit the Ocean Star Offshore Drilling Rig & Museum, then step back in time to the Victorian era to browse “The Strand” galleries and shops. Explore the Elissa Sailing Vessel, the Old Confectionery, the Railroad Museum, and Col. Bubbie’s, then lunch at a seafood, Italian, or American-style restaurant. Next, we leave Galveston for the Haak Vineyards and Winery in Santa Fe, Texas, for a tour and wine tasting.

For a full description of tours and seminars, plus periodic updates, please visit the joint annual meeting Web site, www.acsmeetings.org/programs/guests-and-companions/. For Houston venues and upcoming events, go to www.visithoustontexas.com and www.artshound.com, and remember to check out Houston Greeters at www.houstongreeters.org/.
Graduate Students: Are you interested in improving your chances of receiving a GSA student research grant or looking for tips to improve your proposal writing for future funding? Then GSA's free proposal-writing workshop is for you!

Led by a member of the GSA Research Grant Committee, this workshop will be based on recent GSA graduate research grant proposals. The workshop will put several examples into hypothesis-driven studies to illustrate the dos and don'ts of the proposal-writing process. The review process of the GSA Research Grant Committee will also be outlined.

Check www.geosociety.org/grants in August for updates on the date, time, and location for this annual workshop.

The Tyler Prize Executive Committee announces the awarding of the 2008 Tyler Prize for Environmental Achievement to Professors James N. Galloway and Harold A. Mooney, for their contributions to earth system science through their research on local and global biogeochemical processes as modified by human impact, and alerting the international community to the environmental consequences of these modifications.

James N. Galloway is recognized for his quantitative characterization and detailing of biogeochemical cycles, the multiple impacts of human inputs to them, and the consequences for the global environment, particularly as illustrated by his development of the “nitrogen cascade”.

Harold A. Mooney is recognized for his contributions to community ecology by integrating population and physiological studies at the global scale, the application of convergent evolution to community structure, and as a central figure in launching many major international ecology programs.

For additional information and nominations contact:
Dr. Linda E. Duguay, Executive Director, The Tyler Prize
Phone (213) 821-1335, Fax (213) 740-5936
Email: tylerprz@usc.edu
Home page www.usc.edu/tylerprize
The Tyler Prize is administered by The University of Southern California

The Tyler Prize was established in 1973 by the late John and Alice Tyler as an international award honoring achievements in environmental science, policy, energy and health of worldwide importance conferring great benefit on humanity. The Tyler Prize consists of a cash award of $200,000 and a gold Tyler Prize medallion.

Recent Laureates
2007 Gatze Lettinga, for Treatment of Polluted Wastewater
2006 David W. Schindler and Igor A. Shiklomanov, for Natural and Human Impacts on Freshwater Resources
2005 Charles David Keeling and Lonnie G. Thompson, for Atmospheric Chemistry and Glaciology related to Climate Change
2004 The Barefoot College and Red Latinoamericana de Botánica (RLB), for Environmental Education
2003 Sir Richard Doll, Hans Herren and Yovel Margalith, for Environmental Medicine and Public Health

Dr. Owen T. Lind, Chair, Baylor University
Dr. Rosina M. Bierbaum, University of Michigan
Dr. Robert A. Frosch, Harvard University and Woods Hole Oceanographic Institution
Dr. Arturo Gómez-Pompa, University of California, Riverside and Universidad Veracruzana

5K FUN RUN/WALK
Hosted by The American Society of Agronomy
Tuesday, 7 October 2008, 6:45 a.m.
Cost: US$20

All attendees, guests, and friends are invited to join us for the 2008 Joint Annual Meeting 5K Fun Run/Walk! The run/walk will take place at Buffalo Bayou, on the west side of downtown. The Bayou's jogging and walking trails are within 1 mile of convention hotels. Meet at 6:30am for check-in; the run/walk begins at 6:45am. Participation t-shirts and refreshments will be provided at the completion of the race.
In this Memoir, Burke and Gunnell draw on anglophone and francophone work to analyze the African continent’s distinctive basin-and-swell topography. Exploring topics such as landforms, bauxites and laterites, fission-track studies, climatic changes, volcanic rock distribution, hotspots, mantle plumes, and rifts, as well as deep and shallow mantle geophysics, ocean floor evolution, continental flooding, and offshore sediment deposition, the authors have pieced together a coherent, continent-wide reconstruction of landscape development during the past 200 million years. Two episodes of continental breakup and the formation of ocean floor were followed by erosion that reduced the continent to a low-elevation and low-relief African Surface by Late Cretaceous times. Africa’s present-day topography developed mostly during the past 30 million years as the African Surface underwent swell uplift and climate changed radically after the Antarctic ice sheet first formed. Northern Hemisphere glaciation and related Sahara initiation 3 million years ago were Africa’s most recent great changes.

MWR201, 72 p., ISBN 9780813712017
$45.00, member price $31.50

...your GSA Bookstore.

The Sedimentary Record of Meteorite Impacts
edited by Kevin R. Evans, J. Wright Horton Jr., David T. King Jr., and Jared R. Morrow

Large meteorite impacts are agents of sedimentation; sedimentary particles are generated through brecciation, which then are transported, emplaced, and deposited. Up until the 1960s, the geologic community largely regarded meteorite impacts as geologic side-shows and curiosities, which were inherently controversial. Today, it is widely recognized that large impacts have played a pivotal role in the evolution of Earth’s biota and sculpted the surface of the planet. Although the future holds risks of impact, ancient impact structures may also be viewed as resources, where breccia bodies and peripheral strata host accumulations of hydrocarbons and ore deposits. This Special Paper examines the sedimentary record of impacts, including the generation of impact melts in sedimentary target rocks; structures such as Chesapeake Bay, Gardnos, Lockne, Mjølnir, and Weaubleau; and distal deposits from the Alamo, Avak, and Chicxulub impacts.

SPE437, 213 p., ISBN 9780813724379
$70.00, member price $49.00

www.geosociety.org/bookstore
Pardee Keynote Sessions

INVITED PAPERS

The Pardee Keynote Symposia are made possible by a grant from the Joseph T. Pardee Memorial Fund. Pardee Keynote Symposia are special events of broad interest to the geoscience community. The sessions are interdisciplinary, representing issues on the leading edge of a scientific discipline or area of public policy and addressing broad, fundamental issues. Selection was on a competitive basis. All speakers are invited.

This year, four additional Pardee Sessions have been named as part of the 10 Joint Plenary Sessions. See p. 30.

Cosponsored by Paleontological Society; Cushman Foundation;
GSA Geobiology and Geomicrobiology Div.; GSA Geoscience Education Div.;
Jere H. Lipps, Univ. of California, Berkeley, Calif.; J. William Schopf, Univ. of California, Los Angeles, Calif.
This session celebrates the Paleontological Society’s centennial by highlighting the signal advances made in paleontology over the past 100 years. Presentations will fall into three major themes: (1) unveiling the record of life’s history; (2) paradigm-changing breakthroughs; and (3) paleontology’s contributions to society and the world.

Cosponsored by GSA Sedimentary Geology Div.; S05 Pedology; GSA Quaternary Geology and Geomorphology Div.; Society for Sedimentary Geology (SEPM). Scientific Categories: Paleoclimatology/Paleoceanography; Geochemistry; Quaternary Geology.
Steven G. Driese, Baylor Univ., Waco, Tex.; Lee C. Nordt, Baylor Univ., Waco, Tex.
This session will focus on uniting the efforts of geoscientists studying ancient soil systems with those engaged in studies of modern surface soils and rock weathering, identifying important controls on rates and processes of weathering and soil formation in modern systems and relating these to interpreting climates and landscapes of the past.

Vernon B. Cardwell, Univ. of Minnesota, St. Paul, Minn.; John D. Kiefer, Univ. of Kentucky, Lexington, Ky.
This session will explore the geological and agricultural barriers and challenges of achieving sustainable energy, water, and soil uses for the needs of humans and aquatic and terrestrial life by 2050.

P4. Large-Scale Continental Deformation at Plate Boundaries. Tues., 7 Oct., 1:30 p.m.–5:30 p.m.
Cosponsored by GSA Structural Geology and Tectonics Div. Scientific Categories: Geophysics/Tectonophysics/Seismology; Tectonics; Structural Geology.
Lucy M. Flesch, Purdue Univ., West Lafayette, Ind.; Nathan Niemi, Univ. of Michigan, Ann Arbor, Mich.
This session is dedicated to understanding large-scale continental deformation along the North American plate boundary—both motions and processes. The session will address new results from the Plate Boundary Observatory (PBO), USArray, SAFOD, geologic data, and methods that integrate this data.

Scientific Categories: Public Policy; Geoscience Information/Communication; Geoscience Education.
The recent and rapid increase in demand for geologists has yet to foster a comparable surge in enrollment. Industries served by geology are scrambling for available graduates. Academia’s response is hampered by competing priorities and limited resources. This session assembles diverse perspectives to assess the existence, intensity, and best response to this perceived “workforce crisis” in geology.

A new era of lunar exploration has begun, with current or soon-to-launch missions from Japan (Kaguya), China (Chang’E), the U.S. (Lunar Reconnaissance Orbiter), and India (Chandrayaan). This session will focus on recent and anticipated results from these missions.

This photo of the Moon was taken from Apollo 11 from a distance of roughly 18,000 km. (Apollo 11, AS11-44-6667). Photo AS11-44-6667 courtesy of NASA, ftp://nssdcftp.gsfc.nasa.gov/miscellaneous/planetary/apollo/as11_44_6667.jpg.
Technical Sessions
HOUSTON 2008 JOINT ANNUAL MEETING

Submission deadline: 3 June 2008 • http://gsa.confex.com/gsa/2008AM/index.epl

JOINT SESSIONS


Biofuels Production: Environmental Challenges for Soil and Water. Cosponsored by GSA Hydrogeology Div.; S06 Soil & Water Management & Conservation; S03 Soil Biology & Biochemistry; S11 Soils & Environmental Quality.

Biologically Induced Dissolution and Precipitation of Minerals in Soils and Sediments. Cosponsored by S09 Soil Mineralogy; GSA Geobiology and Geomicrobiology Div.; The Clay Minerals Society; S03 Soil Biology & Biochemistry; S05 Pedology; S07 Forest, Range & Wildland Soils; S10 Wetland Soils; Gulf Coast Association of Geological Societies.


Characterization and Interpretation of Soils and Geologic Formations with Carbonates, Gypsum, and Other Soluble Salts. Cosponsored by GSA Quaternary Geology and Geomorphology Div.; S05 Pedology; S09 Soil Mineralogy; Mineralogical Society of America.

Complexity and Scale in the Critical Zone. Cosponsored by A03 Agroclimatology & Agronomic Modeling; S09 Pedology; GSA Geoinformatics Div.


Developments in Aeolian Research: Bridging the Interface between Soil, Sediment, and Atmosphere. Cosponsored by GSA Quaternary Geology and Geomorphology Div.; S06 Soil & Water Management & Conservation; International Society of Aeolian Research (ISAR); S05 Pedology.

Digital Detection, Interpretation, and Mapping of Soil, Sediments and Bedrock. Cosponsored by GSA Geoinformatics Div.; S05 Pedology; S09 Soil Mineralogy.


Daily Joint Plenary Lectures

These joint sessions encompass the 10 broad, societally relevant and multidisciplinary themes in support of the International Year of Planet Earth. Visit www.acsmeetings.org/program for updates on dates, times, locations, and speakers.

TUESDAY, 7 OCT.

Morning: Wetland and River Restoration: Environmental Saviors or Scientific Failure? GSA Pardee Lecture.


WEDNESDAY, 8 OCT.

Morning: Geobiology and Biomineralization: From the Origins of Life to the Origins of Cities. GSA Pardee Lecture.

Afternoon: Emerging Trace Contaminants in Surface and Groundwater Generated from Waste Water and Soil Waste Application.

Afternoon: Carbon Sequestration: Methods, Markets, and Policy.

THURSDAY, 9 OCT.

Morning: Human Influences on the Stratigraphic Record. GSA Pardee Lecture.
Technical Sessions


Hydrogeomorphology and Hydropedology: Emerging Disciplines that Embrace Earth and Soil Sciences. Cosponsored by GSA Quaternary Geology and Geomorphology Div.; S01 Soil Physics; S05 Pedology; S06 Soil & Water Management & Conservation.

Hydrological Responses to Changing Climate: Implications for Agriculture and Ecosystems. Cosponsored by S06 Soil & Water Management & Conservation; S11 Soils & Environmental Quality; GSA Hydrogeology Div.

Impacts of Energy Development on Water Resources. Cosponsored by GSA Hydrogeology Div.; A05 Environmental Quality; Gulf Coast Association of Geological Societies.


Land Use and Short-Term Erosion Processes. Cosponsored by GSA Quaternary Geology and Geomorphology Div.; S05 Pedology; S06 Soil & Water Management & Conservation; A02 Military Land Use & Management.

Natural Zeolite Utilization in Agriculture, Environmental Science, and Industry: Characterization, Properties, and Applications. Cosponsored by Mineralogical Society of America; S02 Soil Chemistry; S09 Soil Mineralogy; S11 Soils & Environmental Quality.

Organic Contaminants: The Soil and Sediment Reservoir. Cosponsored by S11 Soils & Environmental Quality; S02 Soil Chemistry; S03 Soil Biology & Biochemistry; GSA Geobiology and Geomicrobiology Div.; GSA Geology and Health Div.


Soil Physics and Vadose Zone Hydrology: Our Future Contributions. Cosponsored by GSA Hydrogeology Div.; S01 Soil Physics; S05 Pedology.

Soil Respiration: From Human to Geologic Time Scales. Cosponsored by S03 Soil Biology & Biochemistry; S05 Pedology; S07 Forest, Range & Wildland Soils; S09 Soil Mineralogy; The Clay Minerals Society.

Soils through Time: Critical Zone Studies of Processes and Their Effects. Cosponsored by GSA Quaternary Geology and Geomorphology Div.; Geochemical Society; S05 Pedology.

Subsurface Fate and Transport of Agricultural Contaminants. Cosponsored by GSA Hydrogeology Div.; GSA Geology and Society Div.; S02 Soil Chemistry; S06 Soil & Water Management & Conservation; S11 Soils & Environmental Quality.


Urban Geochemistry and Associated Human and Ecological Health Issues. Cosponsored by S11 Soils & Environmental Quality; S02 Soil Chemistry; GSA Hydrology & Health Div.

Variably Saturated Flow in Soil and Rock: What’s the Same, What’s Different? Cosponsored by S01 Soil Physics; S05 Pedology; GSA Hydrogeology Div.

GULF COAST ASSOCIATION OF GEOLOGICAL SOCIETIES SESSIONS


GC4. Hydrates and Shallow Gas.

GC5. Integrated Pore Pressure Predictions: Case Studies.

GC6. The Geology of the GOM Coastal Plain: Insights into Offshore GOM Exploration.


Technical Sessions


GC15. Gulf of Mexico Coastal Plain Paleontology. Cosponsored by Paleontological Society; Gulf Coast Association of Geological Societies.


GSA TOPICAL SESSIONS

These sessions are topically focused with a mix of invited and volunteered papers. Sessions are designed to promote the exchange of interdisciplinary, state-of-the-art information. In addition to these proposed sessions, GSA will have a multitude of discipline sessions.


T9. Crises on the Reefs? Anticipating the Effects of Global Warming on Reefs by Reference to the Fossil Record—is the Past Really the Key to the Present in the New Field of Conservation Paleobiology? Cosponsored by Paleontological Society; Society for Sedimentary Geology (SEPM); Paleontologic Research Institute; Cushman Foundation; Gulf Coast Association of Geological Societies.


T17. Integration of Soils and Geomorphology in Deserts: A Tribute to the 50 Years of Soil Research of Dan Yaalon. Cosponsored by GSA Quaternary Geology and Geomorphology Div.; S05 Pedology; Gulf Coast Association of Geological Societies.


Be Head of the Class!

Leica Microsystems … Your First Choice for Exploring Geoscience

Best-in-Class! The new Leica DM P Polarizing Digital Microscope Series is designed for high-quality polarizing examination: petrography, mineralogy, structure characterization, and more.

The Leica DM Series; Leica DM EP, DM2500 P, and DM4500 P; includes many advanced features not usually found in teaching pol microscopes:

- Accurate conoscopic examination is simplified with Leica’s conoscopy modules.
- Ergonomically designed microscope adapts to every user and improves workflow.
- Easy, reproducible documentation with Leica’s digital camera and application-specific software options.

For best-in-class geological research, teaching, and learning, choose the new Leica DM P Series. Call Leica today at 800-248-0123. Ask for your free Michel-Levy chart and magnifier bookmark!
Technical Sessions


T27. From Mud to Mudrock: Use of Modern Depositional Settings as Analogs for the Interpretation of Ancient Mudrocks. Cosponsored by Gulf Coast Association of Geological Societies.


T29. Recent Advances in Deepwater Sedimentology: Science Driven by the Search for Natural Resources. Cosponsored by Gulf Coast Association of Geological Societies.


T34. Paleosol Records as Evidences of Environmental Change in Different Time Scales. Cosponsored by GSA International Div.; GSA Quaternary Geology and Geomorphology Div.


T38. Gulf of Mexico Coastal Plain Paleontology. Cosponsored by Paleontological Society; Gulf Coast Association of Geological Societies.


T42. Field and Quantitative Paleontology, Micropaleontology, and Taxonomy: A Memorial to Roger L. Kaesler. Cosponsored by Paleontological Society; Society for Sedimentary Geology (SEPM); Gulf Coast Association of Geological Societies.


T44. Living Soil in Deep Time. Cosponsored by Gulf Coast Association of Geological Societies.


T55. Phylogenetic Perspectives on Assembling the Tree of Life in Deep Time. Cosponsored by Paleontological Society; Gulf Coast Association of Geological Societies.


The Kerry Kelts Research Awards of the Limnogeology Division

Application deadline: 10 August 2008

The application process for the Kerry Kelts Research Awards of the Limnogeology Division is now open. These awards for undergraduate or graduate student research are named in honor of Kerry Kelts, a visionary limnogeologist and inspiring teacher. Up to three awards of US$350 each for use in research related to limnogeology, limnology, and paleolimnology are available. Application for this award is simple: it consists of a summary of the proposed research, its significance, and how the award will be used (five-page maximum). Please send your summary as a PDF file along with your name and a short (two-page maximum) CV to the chair of the Limnogeology Division, Michael Rosen, mrosen@usgs.gov, by 10 August 2008. Awards will be announced at the Limnogeology Division Business Meeting and Reception at the 2008 Joint Annual Meeting in Houston in October.

We hope to increase the amount of the awards in succeeding years. If you are interested in supporting this program, please send your donations, designated for the Kerry Kelts Research Awards of the Limnogeology Division, to GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA.

Field Geology

ILLUSTRATED

Terry S. Maley

First detailed, comprehensive book on field geology in 20 years.

704-page, richly illustrated book with 688 high quality photographs and 300 interpretive sketches; a treasure trove of practical field-related information essential for the recognition, interpretation, and description of geologic features.

This superb field guide includes hundreds of classic USGS photographs and represents some of the best examples available of common and significant geologic features and structures.

2nd edition, 2005, $35.00 plus $4 shipping

Mineral Land Publications, P.O. Box 1186,
Boise, Idaho 83701 Phone: 208-343-9143
gatan gets it

Do you see ppm level differences in mineral chemistry?

To learn how our CL system accomplishes this, visit us at the GSA Meeting or www.gatan.com/answers

ChromaCL™
image showing late-stage hydrothermal chemical alteration (red) associated with cracks in quartz (blue-green) in granite.

Image courtesy of Dr. J. Schieber, Indiana University.


Technical Sessions

**T81. Continental and Marine Fold and Thrust Belts.** Cosponsored by GSA Structural Geology and Tectonics Div.; IUGS Task Group on Structural Geology and Tectonics; Gulf Coast Association of Geological Societies.

**T82. Southwest Pacific Cenozoic Tectonics and Comparisons with Other Orogenic Belts.** Cosponsored by GSA International Div.; GSA Structural Geology and Tectonics Div.; GSA Geophysics Div.; Gulf Coast Association of Geological Societies.


**T85. Magmatic and Tectonic Processes at Ultraslow Mid-Ocean Ridges.** Cosponsored by Gulf Coast Association of Geological Societies.


**T88. Evolution of Simple Granite Systems (Haplogranites) and Rhyolites: A 50th Anniversary Perspective of the Tuttle and Bowen Studies.**

**T89. Origin of the Alkaline Magmatism of the Coast of the Gulf of Mexico and the Rio Grande Rift.** Cosponsored by Gulf Coast Association of Geological Societies.

**T90. Whole Earth Systems Science: New Perspectives on the “Rock Cycle” from the Deep Earth to the Atmosphere to Life.** Cosponsored by Geochemical Society; Gulf Coast Association of Geological Societies.


**T93. Environmental Mineralogy.** Cosponsored by Mineralogical Society of America; Gulf Coast Association of Geological Societies.


**T100. From Magma Oceans to Basalts: Igneous Differentiation on Earth, the Moon, Mars, and Beyond.** Cosponsored by Geochemical Society; Gulf Coast Association of Geological Societies.


**T104. The Role of Field Geology and Geophysics in the Return to the Moon.** Cosponsored by GSA Planetary Geology Div.; Field Exploration and Analysis Team (FEAT).


**T108. Living on a Dusty Moon.** Cosponsored by GSA Planetary Geology Div.; GSA Geology and Health Div.


The Geological Society of America is pleased to announce Lithosphere, a journal to be launched in early 2009. Lithosphere will focus on tectonic processes at all scales that affect the crust and upper mantle, from the surface to the base of the lithosphere, and will highlight research that addresses how the surface, crust, and mantle interact to shape the physical and chemical evolution of the lithosphere at all spatial and temporal scales.

Lithosphere welcomes contributions from a wide variety of earth science disciplines, including (but not limited to) structural geology, geodynamics, tectonic geomorphology, petrology, and geochemistry, as well as results from integrative, interdisciplinary projects (e.g., Canada’s Lithoprobe, EarthScope in the United States). The journal particularly encourages articles that address how complex systems in the solid Earth operate and how coupling between those systems occurs.

Formats include:
• short research contributions (letters) of new and innovative ideas and concepts;
• longer research articles with complete presentations of field-based and other data sets, experimental results, theoretical analyses, or numerical simulations;
• review articles that facilitate communication among disciplines;
• brief overviews of articles in the issue; and
• special issues or sections devoted to a topic.

For information on article submission and other updates, please visit www.gsaajournals.org

Science Editors Named

JAMES P. EVANS, a professor in the Department of Geology at Utah State University, studies deformation and fluid flow in the upper 10 km of the Earth’s crust using mapping, laboratory measurements, geochemistry, computer graphics, and structural analysis. His current research focuses on fault zone studies and hydrology, geological and mechanical models of fault development, relating geological observations to seismologically derived properties of faults, and structural analyses of deformed rocks. He served as associate editor of the Journal of Structural Geology from 1992 to 1997, was chief editor from 1997 to 2002, and also edited two special issues. (http://cc.usu.edu/%7Ejpeevans/index.html)

JON D. PELLETIER is an associate professor in the Geosciences Department of the University of Arizona. His research interests include landforms on Earth’s surface that are sculpted by flowing water in the form of rivers and glaciers and by wind and windborne particles, with a focus on the integration of computer model results with field and remote-sensing data. (http://www.geo.arizona.edu/web/Pelletier/JP_page.html)

RAYMOND M. RUSSO, an assistant professor in the Department of Geology at the University of Florida in Gainesville, has research interests in tectonics and seismology, with emphasis on upper mantle flow and lithosphere-asthenosphere interactions. (http://www.clas.ufl.edu/users/russo/)
MEET DAKOTA!
ONE OF THE BEST PRESERVED AND MOST COMPLETE DINOSAUR MUMMIES EVER FOUND.

…the science is solid and well explained, the people are vivid and real, the adventures are well chosen and the story is well told. Read and enjoy.”
— New Scientist

“…deliciously geeky account of the discovery in 1999 and subsequent investigation of a fossilized hadrosaur named Dakota.”
— The Guardian

“Phillip Manning…has stitched together a very readable account…rewarding for the reader looking for more than a quick glance into the world of the dinosaurs.”
— The Roanoke Times

Grave Secrets of Dinosaurs:
Soft Tissues and Hard Science
Hardcover, 320 pages
$28.00

Available wherever books are sold or call 1-888-647-6733
Visit www.shopng.com/dinos


T122. Soil Geochemistry: Databases and Applications at Regional to Continental Scales. Cosponsored by Geochemical Society; Gulf Coast Association of Geological Societies; GSA Geology and Health Div.

T123. Real-Time, In-Field Geochemical Analysis: Current Capabilities and Future Prospects (Posters). Cosponsored by International Association for GeoChemistry; Gulf Coast Association of Geological Societies.


T134. Novel Usage of Complimentary Techniques to Characterize Low-Temperature Biogeochemical Environments.


T139. Sources, Transport, Fate, and Toxicology of Trace Elements in the Environment. Cosponsored by International Association for GeoChemistry; GSA Hydrogeology Div.

T140. Sigma Gamma Epsilon Undergraduate Research (Posters). Cosponsored by Sigma Gamma Epsilon.


T142. Soils as Components of Archaeological Landscapes. Cosponsored by GSA Archaeological Geology Div.; GSA Quaternary Geology and Geomorphology Div.; S05 Pedology; Gulf Coast Association of Geological Societies.

T143. The Origin of Mima Mounds and Similar Micro-Relief Features: Multidisciplinary Perspectives. Cosponsored by GSA Archaeological Geology Div.; GSA Quaternary Geology and Geomorphology Div.; S05 Pedology; Gulf Coast Association of Geological Societies.

Technical Sessions


T146. Hypogenic Karst: Shedding Light on Once Poorly Understood Hydrologic and Morphologic Features. Cosponsored by National Cave and Karst Research Institute; Gulf Coast Association of Geological Societies.


T164. Hydropedology of Hillslopes.


Technical Sessions


T180. Paleontology through the Ages—Teaching, Learning, or Both. Cosponsored by Paleontological Society.


T183. Best Practices in Distance Education in the Geosciences. Cosponsored by Gulf Coast Association of Geological Societies.

T184. Advances in Using Recent and Emerging Technologies to Facilitate Learning of the Geosciences in the Classroom, Laboratory, and Field. Cosponsored by Gulf Coast Association of Geological Societies.


T191. Quantitative and Qualitative Methods and Results in Geoscience Education. Cosponsored by GSA Geoscience Education Div.; Gulf Coast Association of Geological Societies.


Technical Sessions


T203. Geology and Health Issues in Texas, Mexico, and Beyond. Cosponsored by GSA Geology and Health Div.; Gulf Coast Association of Geological Societies.

T204. Wastewater Recycling and Disposal in Diverse Environments: Challenges and Creative Solutions (Posters). Cosponsored by EarthScope: Bringing Geology and Geophysics Together to Study the 4-D Evolution of the Lithosphere.


T209. Forensic Geology.
Be sure to visit the

JOINT ANNUAL MEETING

BULLETIN BOARD

Here you’ll have a chance to meet other meeting attendees and talk about whatever you want, whenever you want. Meet new people, coordinate your schedules, and plan activities. You can even save money by sharing travel and lodging expenses.

It’s easy and it’s free!

To get started, go to http://www.acsmeetings.org/housing-and-travel/discussions.

It’s not too soon to start planning for Houston.

See you there!

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

WE PURCHASE BOOKS AND ENTIRE COLLECTIONS
MS Book and Mineral Company
P.O. Box 6774, Lake Charles, LA 70606-6774 USA.

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

Albuquerque Elko Houston Las Vegas
Orange Orlando Pensacola Phoenix
Sacramento San Francisco

First Time in English —
The Public Fountains of the City of Dijon
Henry Darcy 1856

English Translation by Patricia Bobeck, P.G.
Includes the Darcy’s Law Experiments
Winner, 2004 Berger Prize for Excellence in Translation
Hardbound • 505 pages + 28-page atlas

$99 www.pbobeck.com

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

WE PURCHASE BOOKS AND ENTIRE COLLECTIONS
MS Book and Mineral Company
P.O. Box 6774, Lake Charles, LA 70606-6774 USA.

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

Albuquerque Elko Houston Las Vegas
Orange Orlando Pensacola Phoenix
Sacramento San Francisco

First Time in English —
The Public Fountains of the City of Dijon
Henry Darcy 1856

English Translation by Patricia Bobeck, P.G.
Includes the Darcy’s Law Experiments
Winner, 2004 Berger Prize for Excellence in Translation
Hardbound • 505 pages + 28-page atlas

$99 www.pbobeck.com

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

WE PURCHASE BOOKS AND ENTIRE COLLECTIONS
MS Book and Mineral Company
P.O. Box 6774, Lake Charles, LA 70606-6774 USA.

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

Albuquerque Elko Houston Las Vegas
Orange Orlando Pensacola Phoenix
Sacramento San Francisco

First Time in English —
The Public Fountains of the City of Dijon
Henry Darcy 1856

English Translation by Patricia Bobeck, P.G.
Includes the Darcy’s Law Experiments
Winner, 2004 Berger Prize for Excellence in Translation
Hardbound • 505 pages + 28-page atlas

$99 www.pbobeck.com
Plumes and Their Role in Whole Mantle Convection and Recycling

Pico, the Azores
17–21 September 2008

Application deadline: 25 June 2008

Conveners

Christoph Beier, Macquarie University, Dept. of Earth and Planetary Sciences, Room 216, Building E5B, Sydney NSW 2109, Australia, cbeier@els.mq.edu.au

Tracy Rushmer, Macquarie University, Dept. of Earth and Planetary Sciences, Key Centre Geochemical Evolution and Metallogeny of Continents, Room 423, Building E7A, Sydney NSW 2109, Australia, trushmer@els.mq.edu.au

Simon Turner, Macquarie University, Dept. of Earth and Planetary Sciences, Room 215, Building E5B, Sydney NSW 2109, Australia, sturner@els.mq.edu.au

Elizabeth Widom, Miami University, Dept. of Geology, 114 Shideler Hall, Oxford, Ohio 45056, USA, widome@muohio.edu

Zilda Franca, Universidade dos Açores, Departamento de Geociências, Apartado 1422, 9501-801 Ponta Delgada, Portugal

DESCRIPTION AND OBJECTIVES

The model of rising mantle plumes and hotspots from the core-mantle boundary first invoked by W.J. Morgan (1971, Nature, v. 230, p. 42–43) has been used for the establishment of geochemical and geophysical models, but the model of mantle plumes is a matter of intense and active debate. Despite the ongoing controversy about the existence of mantle plumes and their possible connection to the lower mantle or even core-mantle boundary, the existence of melting anomalies in Earth's upper mantle cannot be denied. The main topic of this conference focuses on melting anomalies/mantle plumes largely independent of their origin and therefore differs from earlier meetings. Instead of aiming to solve the outstanding issue of whether mantle plumes exist we focus on the geophysical and geochemical aspects of well-established melting anomalies/mantle plumes, such as the Azores.

There is increasing evidence that some mantle plumes rise from the core-mantle boundary and accordingly there is much interest in the role they play, not only in whole mantle convection, but also in the recycling of near surface materials. The buoyancy flux of mantle plumes varies by a factor of three or more, and much study has concentrated on the high flux Hawaiian plume. The Azores plume provides an interesting contrast because of its low buoyancy flux and the large variation in radiogenic and stable isotopes in erupted products. Additionally, it has long been suggested that the Azores reflect melting in the presence of volatiles as well as elevated temperatures. Thus, whilst the Azores plume cannot transport as much heat as Hawaii, it may contain the best evidence for recycling of materials subducted beneath an arc. Several recent studies have suggested that this may have occurred ca. 2.5–3 Ga, making the Azores unique in providing evidence for Archaean subduction and very long-term storage of this material in the mantle.

In the light of the importance and impact of mantle plumes to the geodynamic evolution and behavior of Earth's mantle, it is important to bring together geochemists, experimentalists, modelers, and seismologists in particular who have expertise in the Azores and other mantle plumes.

We will discuss our present understanding of melting anomalies/mantle plumes and which issues still need to be resolved. We will be based at the Aldeia da Fonte Hotel, in Pico, Azores. The meeting includes three days of presentations and two days of field observations. Participants should plan on arriving on Pico on Tuesday, 16 September.

PROPOSED ITINERARY

Day 1—Wed., 17 Sept.: Invited speaker presentations/posters: Azores volcanology overview, geophysics and numerical modeling. Discussion will take place after each presentation, with another discussion session at the end of the day.

Day 2—Thurs., 18 Sept.: Field trip on Pico (coordinated with Zilda Franca): This trip will include an overview of the tectonics, evolution, and morphology of the island, lava flows and lava tubes, and an ankaramite outcrop.

Day 3—Fri., 19 Sept.: Invited speaker presentations/posters: Azores geology overview, geochemistry, and isotope geology, with discussion after each presentation and at the end of the day.

Day 4—Sat., 20 Sept.: Field trip on Faial (coordinated by Zilda Franca and Victor Hugo Vorjaz): This trip will include an excellent xenolith locality and outcrops of the 1957 Capelhinos eruption.

Day 5—Sun., 21 Sept.: Synthesis day: The final day will be restricted to two to three invited lectures, and we plan to leave time open for impromptu presentations from participants as part of our synthesis.
The field trips on Pico and on Faial will cover the most frequent eruption styles and tectonic features in the Azores and may provide the ideal overview for conference participants. Depending on interest, we would also like to offer a pre- or post-meeting field trip to the island of São Miguel. This island is unique in many aspects (e.g., tectonics, geochemistry) and would provide a unique opportunity for participants to gain an understanding of the tectonics, geology, and geochemistry, and to collect samples.

ATTENDEES AND ESTIMATED COST
Participation of graduate students is especially encouraged, and partial support to attend the meeting is being actively sought by the organizers. Participants must make their own travel arrangements to and from the Azores. The registration fee is US$1300, which will cover six nights hotel lodging (16–21 Sept.), meals, guidebook, and all transportation (e.g. ferries and buses). Airfare and ferry service to/from the Azores and Pico are not included and are at the participants’ expense.

REGISTRATION APPLICATIONS AND INFORMATION
Interested persons should send a letter of application by e-mail to penrose2008@els.mq.edu.au. The letter should include a brief statement of the applicant’s research interests and the relevance of those interests to the focus of the conference. Please also indicate if you are interested in a pre- or post-meeting field trip to the island of São Miguel.

The Quaternary is a system/period with its base coinciding with that of the Pleistocene series/epoch and is defined by the Global Stratotype Section and Point (GSSP) at Vrica, Italy, which has been dated at ca. 1.806 Ma. In the late 1990s and again today, many Quaternary scientists have argued that the boundaries of these units should be redefined to coincide with the GSSP for the upper Pliocene Gelasian Stage, which has been dated at ca. 2.588 Ma. This proposal has been resisted by those who prefer that the definitions remain unchanged and others who propose that the Quaternary System/Period be eliminated and that the Neogene be extended upward to include the Pleistocene and Holocene. Others even wish to reinstate the Tertiary.

These issues are contentious and controversial, but they must be settled if the upper and recent parts of the International Stratigraphic Chart and Geologic Time Scale, respectively, are to be finalized and given permanent stability. Now is the time to settle them. Accordingly, a special two-hour meeting will be held at the International Geological Congress (IGC) in Oslo to hear positions on all sides of the issues. All IGC attendees who wish to contribute to or observe these discussions are welcome. Proponents wishing to present positions at the meeting should contact either of the co-chairs, who will organize the discussion to ensure that all major positions and arguments on the issues are presented. Following this discussion meeting and extensive collaboration at the IGC, the International Commission on Stratigraphy will develop a plan to receive formal proposals for stratigraphic revisions and will move forward expeditiously with their consideration and evaluation.

This open evening meeting will directly follow Symposium HPS-07 (Pliocene-Pleistocene correlations and global change). The science presented in that symposium will be a basis for positions and arguments in the discussion meeting.

33rd International Geological Congress, Oslo, Norway

Redefinition of the Quaternary and Pleistocene: Open Discussion

Stanley C. Finney, vice-chair and chair-elect of the International Commission on Stratigraphy (ICS-IUGS), scfinney@csulb.edu

John J. Clague, past-president, International Union for Quaternary Research (INQUA), jclague@sfu.ca

The Quaternary is a system/period with its base coinciding with that of the Pleistocene series/epoch and is defined by the Global Stratotype Section and Point (GSSP) at Vrica, Italy, which has been dated at ca. 1.806 Ma. In the late 1990s and again today, many Quaternary scientists have argued that the boundaries of these units should be redefined to coincide with the GSSP for the upper Pliocene Gelasian Stage, which has been dated at ca. 2.588 Ma. This proposal has been resisted by those who prefer that the definitions remain unchanged and others who propose that the Quaternary System/Period be eliminated and that the Neogene be extended upward to include the Pleistocene and Holocene. Others even wish to reinstate the Tertiary.

These issues are contentious and controversial, but they must be settled if the upper and recent parts of the International Stratigraphic Chart and Geologic Time Scale, respectively, are to be finalized and given permanent stability. Now is the time to settle them. Accordingly, a special two-hour meeting will be held at the International Geological Congress (IGC) in Oslo to hear positions on all sides of the issues. All IGC attendees who wish to contribute to or observe these discussions are welcome. Proponents wishing to present positions at the meeting should contact either of the co-chairs, who will organize the discussion to ensure that all major positions and arguments on the issues are presented. Following this discussion meeting and extensive collaboration at the IGC, the International Commission on Stratigraphy will develop a plan to receive formal proposals for stratigraphic revisions and will move forward expeditiously with their consideration and evaluation.

This open evening meeting will directly follow Symposium HPS-07 (Pliocene-Pleistocene correlations and global change). The science presented in that symposium will be a basis for positions and arguments in the discussion meeting.
INTRODUCTION

During the twentieth century, geological opinion about Clarence Dutton turned nearly 360 degrees. In 1902, the Nicaragua Canal Commission proclaimed that “no one (was) better qualified” to speak on volcanology and seismology. Writing in the Bulletin of the Seismological Society of America nine years later, J.S. Diller termed him “the first seismologist of his country.” Yet by 1935, his principal biographer (Wallace Stegner) lamented that he was almost completely forgotten except as “the author of a few fine but impersonal books” and focused on his unique literary skills rather than on his profound contributions to geology.

Indeed, in mid-century America, Dutton was remembered hazily if at all—perhaps most commonly as an assistant to John Wesley Powell and—incorrectly—as the creator of the concept of isostasy (Dutton created the word isostasy but merely resurrected and decisively championed the concept). Yet in the twenty-first century, university presses already have reprinted two of his great U.S. Geological Survey reports of the 1880s with new, thoroughly researched forewords. In 1999, Naomi Oreskes hailed him not only as “the grand old man of isostasy” but as the first to reject the contraction theory of orogeny, with recognition of plastic flow beneath the crust. In 2005, James Lawrence Powell went farther, placing Dutton in a group of geologists (Newberry, J.W. Powell, Gilbert, and Dutton) he considered “among the greatest of any century. Collectively they redefined the science of geology” (p. 4). The university press reprints emphasized the timeless and superlative literary skills of his writings rather than advertising them as classics of geological science, but today it seems entirely appropriate for Dutton's name to remain attached to cliffs, ridges, and points from Oregon's Crater Lake to the Grand Canyon of Arizona.

DUTTON AND DANA: THE EARLY YEARS

Dutton came from an upwardly mobile New England family and matriculated at Yale College at age 16. There he was noted as an oarsman and public speaker; his best subjects were mathematics and literature. As a senior, he won the annual Yale Literary Prize. He was not a disciple of Yale's famous James Dana, who began his professorial duties about the time of Dutton's matriculation. Specifically, Dutton rejected both Dana's religiosity and, later, his simile of an Earth ridged with mountains, cooling and contracting like a shriveling apple. It is not certain that Dutton even attended any of Dana's lectures, but the two maintained a tenuous lifelong relationship.

After graduating at 19, Dutton was severely injured in the Civil War but emerged as a career officer in the Ordnance Corps. As a mere lieutenant, he was in charge of the ordnance of the Army of the Potomac. His first post-war billet was near Albany, New York. Here his powerful intellect was “turned on” by geologists James Hall and R.P. Whitfield, who did not share Dana's vision of a “shriveling apple” Earth. Just to the west rose the fossiliferous ramparts of the horizontally bedded Helderberg Plateau. Suddenly, geology made sense to Dutton. During later assignments in Philadelphia and Washington, D.C., he was quickly accepted into their scientific establishments for his geological knowledge and his quick understanding. In Washington, he became a close friend and coworker with both John Wesley Powell and G.K. Gilbert. This marks the beginning of a new school of American geology.

DUTTON AND POWELL

At the urging of Powell and other influential members of the Washington establishment, Congress repeatedly approved Dutton's temporary detachment from the Army to become a leader in Powell's western field teams. This peculiar arrangement lasted fifteen years and produced five of the most notable reports in American geological history. Back home in Washington, D.C., for six months each year, he and Powell founded the spectacularly successful Cosmos Club. For a dozen years they were honored members of its inner circle of world leaders.

Employing leadership skills honed by his wartime responsibilities, Dutton admirably conducted and reported on initial field assignments in the southwestern United States. Despite its daunting title, his Tertiary History of the Grand Cañon District (1882) quickly popularized the sublimity of that incomparable chasm. He was scheduled to lead similar field work in the Cascade and Klamath Mountains of Oregon and California, but something peculiar intervened. With decidedly lame explanations, he was dispatched to the Kingdom of Hawaii on very short notice. From this surprising field season came his delightful book Hawaiian Volcanoes (1884). It too was a formal U.S.
Geological Survey report divided about equally between straightforward geology and lyrical descriptions of nature and is usable today as a “roadside geology of Hawaii.” Moreover, it is notable for a sprinkling of keen sociopolitical observations, largely absent from his other U.S. Geological Survey reports. This was a critical time for the shaky Hawaiian monarchy, and the recurrent question of annexation by the United States was much debated in Washington, D.C. Dutton returned from Hawaii an outspoken advocate for the Hawaiian people and an effective opponent of annexation, which did not happen until 1898, after he had left Washington.

Dutton spent two additional field seasons in the western plateau country before going to Oregon. From these two seasons came a third report, completing a remarkable trilogy on the geomorphology of the high plateau country of the western United States. In Oregon, he plumbed the extraordinary depth of Crater Lake and, with pioneer conservationist W.G. Steel, began the creation of Crater Lake National Park. Before he could prepare his report on this largely volcanic terrain, however, Powell had to detach him to head the investigation of the devastating 1886 Charleston, South Carolina, earthquake. His landmark report on that tragic event established him as a world authority in seismology, but it lacked the wide public appeal of his earlier trilogy. Today it is virtually forgotten.

DUTTON’S LATER YEARS

At age 48, Dutton’s life took another drastic turn and he suddenly reverted to his military persona. The transfer may have resulted from Powell’s resignation from the Geological Survey, but Dutton’s promotion to major and his appointment as commandant of the San Antonio Arsenal suggest that he was not directly involved in Powell’s downfall, and that he instead received well-merited rewards from a grateful establishment.

While he was in Texas, he began to show chronic ravages of what almost certainly was “consumption”—tuberculosis—then a devastating disease traditionally considered a social stigma. In the dreadful conditions of the Civil War and the miserable quarters characteristic of western field seasons, Dutton must have been exposed repeatedly. The clean, fresh air of the dry American southwest was believed to be helpful for consumption, but it did not help Dutton. By the end of his decade in Texas, he was prematurely enfeebled. Nevertheless, he accomplished a notable military intelligence assignment in addition to his light duties as commandant. At this time, Panama and Nicaragua were competing for an inter-ocean canal. Dutton was assigned to determine if the volcanic Nicaraguan route was feasible. As a geological engineer, he determined that it was viable but that it would be a stupendous engineering feat. With today’s Panama Canal increasingly inadequate for modern shipping, his conclusions remain relevant today. Perhaps Dutton’s surprising Hawaii assignment also was a cover for him to assess the volatile political situation there.

At 58, Dutton returned to Washington as assistant to the chief of the Ordnance Corps, but he was progressively disabled and retired two years later. His intellect was unimpaired, and in 1904 he published a milestone book on earthquakes as effects of geological processes, not their causes—then a startling new concept. With his enormous contributions in geomorphology rapidly fading from memory, it earned him new plaudits as a seismologist. A year later, his last major publication concerned the recent discovery of radioactivity. This he interpreted as a missing link without which all speculations about the cause of volcanism had been premature.

DUTTON AND DANA AS VOLCANOLOGISTS

As a young man, James Dwight Dana was the official geologist of the controversial United States Exploring Expedition headed by Charles Wilkes, but his personal observations on the landmark island of Hawaii in 1840, directed as they were by Wilkes, were incomplete. There, hampered by limited geodetic data, he even considered Kilauea Volcano to be another part of Mauna Loa. Dutton’s 1884 *Hawaiian Volcanoes* must have been a great surprise to the noted older authority, since it combined new maps and a range of fresh observations; the septuagenarian professor, already on his way to monitoring changes in Kilauea crater through time, used Dutton’s summary to good advantage and soon found his way back to Hawaii, accompanied by his wife and daughter. Although the journey seems to have been mostly a family junket, he gathered enough new data to prepare his famous book *Characteristics of Volcanoes* (1890). It earned him the title of Father of American Volcanology.

Perhaps Dutton should be acclaimed its godfather.

ACKNOWLEDGMENTS

Together with Dutton’s own writings, this summary is drawn primarily from Diller’s brief biographical sketches in 1911 and 1913; from Wallace Stegner’s 1936 Ph.D. thesis and his subsequent 1953 *Beyond the 100th Meridian*; and from James Powell’s 2005 geological history of the Grand Canyon. I deeply appreciate the encouragement and assistance of Gary Rosenberg, Robert Ginsburg, James H. Natland, and other members of the GSA History of Geology Section and of Keith Leber of the University of Hawaii Press.

GSA Strengthens Its Presence in Washington

Craig M. Schiffries, GSA Director for Geoscience Policy

Created as part of GSA's National Leadership Initiative, GSA's geoscience policy office in Washington, D.C., opened on 17 September 2007 in the American Association for the Advancement of Sciences headquarters building, 1200 New York Avenue NW, suite 700. GSA established this office to further the Society's core mission to be a leader in advancing the geosciences while enhancing the professional growth of its members and promoting the geosciences in the service of humankind.

The overarching goal of the D.C. office is to provide GSA and its members with leadership in public policy through active involvement in public policy decision-making and implementation processes. The office fulfills this goal through four major areas of activity:

- Monitoring public policy issues and participating in information-sharing and educational efforts directed toward the legislative and executive branches of government;
- Working with the GSA community to increase member involvement in public policy–related activities;
- Supporting adequate funding for science at the federal level; and
- Encouraging and improving the use of scientific information in decision making in the public policy arena.

USGS Coalition

On the Washington office’s first day of operation, GSA cosponsored the 4th Annual USGS Coalition Reception on Capitol Hill. Representative John T. Salazar (D–Colo.), Representative Ciro D. Rodriguez (D–Tex.), and U.S. Geological Survey (USGS) Director Mark Myers delivered brief remarks, and more than 150 people from Congress, federal agencies, and nongovernmental organizations participated in the reception and exhibition. This event is geared toward raising congressional awareness of the USGS, recognizing congressional champions for the USGS, and drawing attention to the need for increased investment in this critical science agency.

GSA is a founding member of the USGS Coalition, which has grown into an alliance of 70 organizations united by a commitment to the continued vitality of the unique combination of biological, geographical, geological, and hydrological programs of the USGS. The coalition is co-chaired by GSA and the American Institute of Biological Sciences.

Coalition for National Science Funding

On the office’s second and third days of operation, GSA staff participated in the Coalition for National Science Funding (CNSF) Congressional Visits Day to advocate for increased funding for the National Science Foundation. GSA was responsible for organizing and leading multidisciplinary constituent meetings with members of the congressional delegations for Colorado and Texas. GSA Members participated in meetings with Senator Wayne Allard (R–Colo.), Representative Chet Edwards (D–Tex.), and congressional staff from other House and Senate offices. GSA Members also attended presentations by Representatives Vernon Ehlers (R–Mich.) and Patrick Kennedy (D–R.I.).

GSA is an active member of the Coalition for National Science Funding, which supports the goal of increasing the national investment in the National Science Foundation’s research and education programs in response to the unprecedented scientific, technological, and economic opportunities facing the United States.
Science-Engineering-Technology Congressional Visits Day

Former GSA President Mary Lou Zoback and GSA Councilor John Geissman were among four scientists and engineers who spoke at a press conference in the U.S. Capitol with Representative Rush Holt (D–N.J.) and Representative Judy Biggert (R–Ill.), co-chairs of the Congressional R&D Caucus, to address the severe repercussions of recent underfunding of key science agencies. The press conference was convened in conjunction with the 13th Annual Science-Engineering-Technology (SET) Congressional Visits Day on 4–5 March 2008.

GSA is a member of the Science, Engineering, and Technology Working Group that organized the SET Congressional Visits Day. More than a dozen GSA Members participated in the event, which included a reception and awards ceremony with Representative Bart Gordon (D–Tenn.), chair of the House Committee on Science and Technology; a congressional breakfast with Sherwood Bohlert, former chair of the House Committee on Science and Technology; orientation sessions with congressional staff and representatives of federal science agencies and professional societies; and small constituent meetings with House and Senate offices. A broad cross section of more than 250 scientists, engineers, and graduate students from academia, government, and private industry had the opportunity to present their perspectives on the importance of basic research to future innovation and competitiveness and to promote federal support for research and development. GSA encourages all its members, including students, to participate in future congressional visits days.

Congressional Briefing on Tsunami Warnings

On 14 March 2008, GSA cosponsored a congressional briefing in the U.S. Capitol on “Improving Tsunami Warnings Nationwide.” Former GSA President Mary Lou Zoback served as moderator for presentations by representatives of the National Oceanic and Atmospheric Administration (NOAA), the U.S. Geological Survey (USGS), and Pacific Gas and Electric Company that summarized improvements to the U.S. tsunami warning system and the role and status of observatory networks and warning centers.

After more than 200,000 people died as a result of the December 2004 Sumatra earthquake and Indian Ocean tsunami, U.S. federal agencies quickly addressed the question of how to protect ourselves from similar events. The White House Office of Science and Technology Policy coordinated a response by NOAA and the USGS on nationwide improvements to tsunami hazard mitigation. Prompt congressional action enabled these federal agencies to carry out effective disaster mitigation that included:

- Deploying additional buoy systems operated by NOAA;
- Expanding real-time telemetry of the Global Seismographic Network;
- Upgrading the capabilities of the USGS’s National Earthquake Information Center; and
- Constructing a comprehensive tsunami warning system for the Caribbean Sea.

Available at the GSA Bookstore

Special Paper 438

Ophiolites, Arcs, and Batholiths: A Tribute to Cliff Hopson
edited by James E. Wright and John W. Shervais
SPE438, 572 p., ISBN 9780813724386
List Price $130.00, member price $91.00
Call for GSA Committee Service

Your Science, Your Colleagues, Your Society:
Make an Impact—Serve on a GSA Committee!

2009–2010 COMMITTEE VACANCIES
DEADLINE: 15 JULY 2008

Now is your chance to influence your Society, your science, and your colleagues, and play an active role in an organization that has been serving geoscientists since 1888. GSA invites you to volunteer or nominate one of your fellow GSA Members to serve on a Society committee or as a GSA representative to other organizations.

Younger members are especially encouraged to become involved in Society activities both as committee volunteers and as nominators: graduate students are eligible to serve on GSA committees as full members.

If you volunteer or make recommendations, please give serious consideration to the specified qualifications for serving on a particular committee (see www.geosociety.org/aboutus/committees/0803commVacancies.pdf) and be sure that your candidates are GSA Members or Fellows.

To volunteer or nominate someone else, go to www.geosociety.org/aboutus/committees and follow the link to our online form, or download the form and complete it on paper. If you use the paper form, please return it to Pamela Fistell, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA; fax +1-303-357-1070. Questions? Please contact Pamela Fistell at +1-303-357-1000, ext. 0, +1-800-472-1988, ext. 0, or pfistell@geosociety.org. Please use one form per candidate.

Nominations received at GSA headquarters by 15 July 2008 on the official one-page or online form will be forwarded to the Committee on Nominations. The committee will present at least two nominations for each open position to the GSA Council at its fall meeting. Appointees will then be contacted and asked to serve, thus completing the process of bringing new expertise into Society affairs.

For details, including term and time commitments and the number of vacancies for each committee, please see the March or April/May issues of GSA Today or go to www.geosociety.org/aboutus/committees. Past issues of GSA Today are accessible online at www.gsajournals.org.

Nominate Your Next Officers and Councilors!

Nominations accepted until 15 July 2008

The GSA Committee on Nominations requests nominations for officers (vice president and treasurer) and Councilors to serve on GSA Council beginning in 2009. Each nomination should be accompanied by basic data and a description of the qualifications of the individual for the position recommended.

Find the online nomination form at www.geosociety.org/aboutus/officers.htm or send materials for officer and councilor nominations to Pamela Fistell, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA, pfistell@geosociety.org.

DEADLINE: 15 JULY 2008

TERMS BEGIN 1 JULY 2009 (UNLESS OTHERWISE INDICATED [SEE WEB SITE]).

GSA Committees with Vacancies
Academic and Applied Geoscience Relations
Annual Program
Arthur L. Day Medal Award
Education
Geology and Public Policy
Honorary Fellows
Joint Technical Program
Membership
Minorities and Women in the Geosciences
Nominations
Penrose Conferences and Field Forums
Penrose Medal Award
Professional Development
Publications
Research Grants
Treatise on Invertebrate Paleontology
Advisory
Young Scientist Award (Donath Medal)

You also have the opportunity to serve as a GSA Representative at the following organizations:
The American Association for the Advancement of Science (AAAS)
AGI Environmental Geoscience Advisory Committee
North American Commission on Stratigraphic Nomenclature
The U.S. National Committee on Soil Science

GSA Today
GA Committees: Progress through Service Committee on Membership

GSA membership continues growing each year, with more than 21,500 members spanning 85 countries. Together, members help shape the future of the geosciences, acknowledge those who make extraordinary contributions to the field, and pave the way for future generations of scientists.

Participation on the Committee on Membership provides the opportunity to contribute to the growth of GSA’s membership community, enhance the member experience, and serve a vital role in the selection of GSA Fellows. Through the collaboration of this committee and other dedicated members working closely with GSA staff, the committee’s goal is to foster a membership community as pertinent and global as our science.

Particular attention for attracting and retaining members is focused on students, professionals working in industry, and those studying or working outside of the United States. Going hand-in-hand with increasing membership is identifying the changing needs of members and a proactive and creative approach to ensure benefits stay relevant for all members—whether professionals, students, K–12 teachers, or affiliates.

In addition to membership development, this committee makes recommendations for Fellowship to the GSA Council. The dedicated time necessary involves reviewing 40–60 nominations and supporting materials, and committee members thus come to the March meeting prepared to discuss the nominations and make final recommendations.

**AN INVITATION TO PARTICIPATE**

The Committee on Membership consists of six members-at-large, one of whom is a student, plus a GSA Councilor—all serving 3-year terms—along with a staff liaison. A committee chair is selected annually. This committee meets twice a year: once in-person (in March, with GSA covering travel costs when requested) and once via a teleconference during September, along with e-mail discussions throughout the year.

Candidates should have an understanding of the needs and interests of members; in particular, students and those working or studying outside of the United States. Additionally, in order to effectively evaluate Fellowship nominations, a well-rounded knowledge of the field of geology, ranging from service to society to research publications, is required.

Please consider volunteering or nominating a colleague whom you feel would contribute well to the future of GSA membership. Details are available at [https://rock.geosociety.org/forms/commonform.asp](https://rock.geosociety.org/forms/commonform.asp).

Heidi H. Natel, Binghamton University, heidi.natel@binghamton.edu
Chair, Committee on Membership

---

Go to [www.gsjournals.org](http://www.gsjournals.org) and click on “Online Journals” then on the link above the *GSA Today* cover. View back issues through the "Archives" button.
REG019: Deep Geologic Repositories
edited by Norbert T. Rempe

Deep Geologic Repositories reviews the success stories of underground waste isolation. It focuses on repositories that did, do, and will permanently and safely isolate dangerous materials from the near-surface biosphere. Complementary topics address the isolation capability of average crustal rock, investigations at one representative underground research laboratory, and the geologic preservation of fission products from Precambrian nuclear reactors. An international cast of contributors presents proven practical solutions to a formerly confounding issue in environmental and engineering geology: What do we do with wastes that retain their dangerous characteristics in human terms forever? The principal answer: Recycling into the lithosphere by “reverse” mining.

REG019, 119 p., ISBN 9780813741192
$50.00, member price $35.00

REG018: Geology of Coal Fires: Case Studies from Around the World
edited by Glenn B. Stracher

Geology of Coal Fires: Case Studies from Around the World is The Geological Society of America’s first publication devoted to “coal-fires science,” an exciting and interdisciplinary area of research gaining international attention in recent years. Coal fires are preserved globally in the rock record as burnt and volume-reduced coal seams and by pyrometamorphic rocks, explosion breccias, clinker, gas-vent-mineral assemblages, fire-induced faulting, ground fissures, slump blocks, and sinkholes. This volume includes chapters devoted to spontaneous combustion and greenhouse gases, gas-vent mineralogy and petrology, paralavas and combustion metamorphic rocks, geochronology and landforms, magnetic signatures and geophysical modeling, remote-sensing detection and fire-depth estimation of concealed fires, as well as coal fires and public policy.

REG018, 278 p. plus index,
ISBN 9780813741185
$80.00, member price $56.00

REG017: Understanding and Responding to Hazardous Substances at Mine Sites in the Western United States
edited by Jerome V. DeGraff

This volume documents interesting approaches, techniques and practical scientific considerations associated with mine site remediation. It also highlights how various federal, state, and local agencies and organizations are trying to bring the best science possible to bear on this serious problem. Some chapters focus on specific methods for characterization, particular contaminant issues, and impacts from the release of hazardous substances from mine and mill sites. Others describe successful response actions, technologies, or practical approaches for addressing contaminant releases to the environment.

REG017, 180 p., ISBN 9780813741178
$60.00, member price $42.00

www.geosociety.org/bookstore
GSA Committees: Progress through Service
Professional Development Committee

The primary mission of the Professional Development Committee (PDC) is to identify short courses for GSA annual meetings. These courses must appeal to a wide audience of society members and fall under three general categories: professional, university-level faculty and graduate students, and K–12 teachers. More courses have been offered in the past several years in an effort to meet the varied needs and interests of society members.

Evaluation and Selection of Short Courses
Short course proposals are due by December each year and are then reviewed and evaluated by the PDC. Following this review, the results of the evaluations are compiled and distributed among the committee members. A committee-wide conference call provides a forum to resolve issues or differences and to determine which courses will be offered.

The primary factors considered in evaluating a course include presenter qualifications, subject matter relevance, cost, and anticipated interest. Another significant source of input is the review comments provided by attendees of short courses held in previous years. The generally positive nature of these comments is gratifying, and the responses have greatly helped us to improve short course quality.

Striving for Excellence
The PDC strives to identify short courses that will provide excellence in educational opportunities for a broad range of GSA Members. The 2008 Houston Joint Annual Meeting is a first for GSA; more than 35 short courses have been accepted for this year’s meeting.

In order to provide a selection of high-quality short courses for the annual meeting, committee members need to be aware of the interests of the society members, current research and recent discoveries in the geosciences, new employment opportunities for student members, and new and innovative approaches for teaching geosciences at all levels.

An Invitation to Serve
The PDC conducts most of its business via e-mail and conference-call discussions. A short meeting held at the 2007 GSA Annual Meeting in Denver helped define committee goals and allowed new members to be introduced to the committee.

PDC members have a broad range of professional and academic experience. This blend of backgrounds is needed to develop a short course selection that will be of maximum benefit to society members. The PDC is supported by GSA headquarters staff, who provide advice to proposers to improve the courses, manage the complex logistics of offering the courses at the meetings, and generally make the work of the committee members easier.

Our vision is to continue to provide the highest quality of educational opportunities to all GSA Members. If you want to share in this vision, please contact us, and we will be glad to forward your statement of interest to the Nominating Committee!

Edward C. Thornton, Battelle Pacific Northwest National Laboratory, ecthornton@embarqmail.com
Cchair, Professional Development Committee
THE PALEONTOLOGICAL SOCIETY

Centennial Celebration

Geological Society of America
Houston, October 2008

Join us all week at PS Booth #568 in the exhibit hall for Centennial treats, a photographic look at the 100 years of the Society, and PS publications!

Saturday, October 4th

8 AM - 5 PM  Centennial Short Course
From Evolution to Geobiology: Research Questions Driving Paleontology at the Start of a New Century
Organized by Patricia H. Kelley and Richard K. Bambach
George R. Brown Convention Center

6:30 PM  Centennial Reception and Dinner
Paleontology Hall, Houston Museum of Natural Science
Tickets available through GSA registration
Free raffle, giveaways, entertainment, and more

Monday, October 6th

8 AM - 12 PM  Pardee Keynote Symposium
Breakthroughs in Paleontology
Organized by Jere H. Lipps and J. William Schopf
George R. Brown Convention Center

4 PM - 6 PM  Awards Reception
Location TBA
No tickets required

PS@100
Building on a great record
see www.paleosociety.org
THE PALEONTOLOGICAL SOCIETY

Centennial
1908 - 2008

Celebrating 100 years of advancement of the science of paleontology
With *Nature Geoscience* now published and online, visit [www.nature.com/naturegeoscience](http://www.nature.com/naturegeoscience) to browse the contents list and abstracts published to date. These first issues reflect the journal’s broad scope, publishing science spanning the Earth’s core, oceans, glaciers, the atmosphere and the planets, using chemistry, physics and biology, and field work as well as modelling. A snapshot of this content published to date includes:

**Progress article:** Widening of the tropical belt in a changing climate, *Dian J. Seidel, Qiang Fu, William J. Randel & Thomas J. Reichler*  
**Review article:** Core–mantle boundary heat flow, *Thorne Lay, John Hernlund & Bruce A. Buffett*  
**Review article:** The methane cycle on Titan, *Jonathan I. Lunine & Sushil K. Atreya*  
**Letter:** Persistent earthquake clusters and gaps from slip on irregular faults, *Tom Parsons*  
**Letter:** Decreased abundance of crustose coralline algae due to ocean acidification, *Ilisa B. Kuffner, Andreas J. Andersson, Paul L. Jakiel, Kuulei S. Rodgers & Fred T. Mackenzie*  
**Letter:** Atmospheric carbon dioxide linked with Mesozoic and early Cenozoic climate change, *Benjamin J. Fletcher, Stuart J. Brentnall, Clive W. Anderson, Robert A. Berner & David J. Beerling*  
**Letter:** A recent volcanic eruption beneath the West Antarctic ice sheet, *Hugh F. J. Corr & David G. Vaughan*  

Enjoy the ‘backstory’, a new section specific to *Nature Geoscience*. In the form of a question-and-answer piece geoscientists tell the story of their research before it was written up neatly in a paper. In the first issue’s ‘backstories’ read about the commute to work by helicopter in the high Arctic; about a black bear climbing easily up an Alaskan glacier moraine that was such a struggle to the scientist and the experience of the team who crossed the equator on the day of the autumn equinox.

Visit [www.nature.com/naturegeoscience](http://www.nature.com/naturegeoscience) to find out more, including options to register for the monthly content e-alert, subscription information and submission guidelines.
Geoinformatics 2008
Data to Knowledge

Discovery, integration, management, and visualization of geoscience data with the goal of improving our understanding of the processes that have shaped Earth and our environment over time will be highlighted at the Geoinformatics 2008 Conference. Globalization of geoinformatics-based research and education in support of meeting societal challenges will also be a significant subject of the conference.

Geoinformatics 2008 provides an international forum for researchers and educators from earth and planetary sciences and information technology–computer science to present new data, data analysis, modeling techniques, visualization schemes, and/or technologies as they relate to developing the cyberinfrastructure for the geosciences.

Hosted by GeoForschungsZentrum Potsdam, Potsdam, Germany

Cosponsored by
The Geological Society of America (Geoinformatics Division)
U.S. Geological Survey
GeoForschungsZentrum Potsdam
British Geological Survey
Bundesanstalt für Geowissenschaften und Rohstoffe
American Geophysical Union
European Geosciences Union

Learn more at www.geosociety.org/meetings/08geoInfo/.

Wonderglobe. Image produced by Reto Stöckli. Used with permission from NASA.
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! Newly updated for 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

---

Now Available through GSA!

**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
Classified Rates—2008

Ads (or cancellations) must reach the GSA Advertising office no later than the first of the month, one month prior to issue. Contact Advertising Department: advertising@geoscience.org; +1.800.472.1988 x1053; +1.303.357.1053. Complete contact information, including mailing and email address, must be included with all correspondence. Rates are in U.S. dollars.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Per Line for 1st month</th>
<th>Per line each additional month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positions Open</td>
<td>$8.00</td>
<td>$7.75</td>
</tr>
<tr>
<td>Opportunities for Students First 25 lines</td>
<td>$0.00</td>
<td>$4.20</td>
</tr>
<tr>
<td>First 25 lines additional lines</td>
<td>$4.20</td>
<td>$4.20</td>
</tr>
<tr>
<td>Fellowship Opportunities</td>
<td>$8.00</td>
<td>$7.75</td>
</tr>
<tr>
<td>Situations Wanted</td>
<td>$3.60</td>
<td>$3.60</td>
</tr>
</tbody>
</table>

To estimate cost, count 54 characters per line, including all punctuation and blank spaces. Actual cost may differ if you use capitals, centered copy, or special characters.

Positions Open

POSTDOCTORAL RESEARCH ASSOCIATE
OLD DOMINION UNIVERSITY

The Ocean, Earth and Atmospheric Sciences program at Old Dominion University seeks an outstanding postdoctoral research associate with strengths in structural geology and an interest in developing integrative, time-series Google Earth models.

The selected candidate will have a Ph.D. in structural geology, with a focus on field data analysis and geological map construction. Experience with Google Earth mark-up language preferred. Preference will be given to candidates that also have a background in one or more of: metamorphic petrology, ductile deformation, large-scale fault systems, or tectonic reconstructions.

The position is for up to two years, available immediately, and renewable for subsequent years depending on the availability of funding and performance of successful candidate. Applications will be reviewed until the position is filled. Application materials should be sent by e-mail to odurjobs@odu.edu or by U.S. mail to Old Dominion University Research Foundation, P.O. Box 6369, Norfolk, VA 23508, USA. Specify Job #08014. AA/EEO.

WILLIAM E. WHITE POSTDOCTORAL SCHOLARSHIP IN GEOLOGICAL SCIENCES AND GEOLOGICAL ENGINEERING, QUEEN’S UNIVERSITY
KINGSTON, ONTARIO, CANADA

The Department of Geological Sciences and Geological Engineering of Queen’s University, one of Canada’s premier earth-science departments, invites applications for its William E. White Postdoctoral Scholarship, created from a fund endowed by the estate of William E. White. The award will be made for one year and may be renewed for a second year. The annual stipend will be no less than $50,000.

The William E. White Postdoctoral Scholarship will be awarded to an outstanding scientist who has completed the Ph.D. degree, normally within the two-year period preceding the time of the appointment. The area of research is open, but the scholar’s research must be complementary to that being pursued in the Department of Geological Sciences and Geological Engineering. The research program to be undertaken and the level of support of research costs and moving expenses will be negotiated with a faculty member at the time the award is made. Potential applicants may obtain an outline of current research interests on the Departmental website www.geol.queensu.ca and are strongly encouraged to initiate contact with a potential faculty supervisor in advance of applying. Fit with the research interests of the Department and the research excellence of the candidate will be the primary considerations in the selection process.

The Department invites applications from all qualified individuals. Queen’s University is committed to employment equity and diversity in the workplace and strongly encourages female and Aboriginal candidates to apply.

We encourage applications from innovative scientists working in all fields of energy geoscience. We are building a body of faculty and scientists to place the school at the forefront of energy geoscience research and teaching for the coming century. Appointments include full-time faculty, full-time research, and mixtures of the two in any Jackson School unit—the Bureau of Economic Geology, the Department of Geological Sciences, or the Institute for Geophysics. For more information on the school and its hiring program visit us online at www.jsg.utexas.edu/hiring.

A PhD is required for appointment. An application should note the title of the specific advertisement you are responding to and include a cover letter, CV, list of publications, list of references, statements of teaching and/or research interests, sent to: Randal Okumura, Office of the Dean / Jackson School of Geosciences, The University of Texas at Austin / PO Box 8, University Station / Austin, TX 78713 or jobs@jsg.utexas.edu.

THE UNIVERSITY OF TEXAS AT AUSTIN IS AN AFFIRMATIVE ACTION / EQUAL OPPORTUNITY EMPLOYER

MULTIPLE HIRES IN ENERGY GEOSCIENCE

The Jackson School is building a premier education and research program in Energy Geoscience. Over the next three years, we seek six or more scientists at the forefront of their disciplines to complement our existing strengths. We seek people attracted to challenging areas of scholarship that require collaboration across disciplines and programs, aimed at the following goals:

- Improve quantitative understanding of sedimentary basins by integrating on all scales classically separated disciplines such as stratigraphy and sedimentology, structural geology and tectonics, geomechanical and diagenetic modeling, geochemistry, basin modeling, petrophysics, and geophysical imaging.

- Determine fluid-rock interactions and the interplay between mechanical and chemical processes influencing fluid flow and storage in the subsurface, especially for carbon sequestration and unconventional sources of fossil energy, such as shale gas and tight gas reservoirs.

- Enhance identification and recovery of energy resources by comprehensive integration of information at all scales, using numerical modeling, and innovative automated monitoring, such as time-lapse seismic and instrumented oil fields.

We encourage applications from innovative scientists working in all fields of energy geoscience. We are building a body of faculty and scientists to place the school at the forefront of energy geoscience research and teaching for the coming century. Appointments include full-time faculty, full-time research, and mixtures of the two in any Jackson School unit—the Bureau of Economic Geology, the Department of Geological Sciences, or the Institute for Geophysics. For more information on the school and its hiring program visit us online at www.jsg.utexas.edu/hiring.

A PhD is required for appointment. An application should note the title of the specific advertisement you are responding to and include a cover letter, CV, list of publications, list of references, statements of teaching and/or research interests, sent to: Randal Okumura, Office of the Dean / Jackson School of Geosciences, The University of Texas at Austin / PO Box 8, University Station / Austin, TX 78713 or jobs@jsg.utexas.edu.

THE UNIVERSITY OF TEXAS AT AUSTIN IS AN AFFIRMATIVE ACTION / EQUAL OPPORTUNITY EMPLOYER

Continued on page 62.
WILLIAM E. WHITE POSTDOCTORAL SCHOLARSHIP
continued from page 61.

welcomes applications from women, visible minorities, aboriginal people, persons with disabilities, and persons of any sexual orientation or gender identity. All qualified candidates are encouraged to apply; however, Canadian citizens and Permanent Residents will be given priority. Applicants should send a curriculum vitae, a statement of research interests, and samples of research writing to the following address. Applicants should contact their referees and arrange for at least three confidential letters of reference to be sent to the address below. Review of complete applications will begin on August 1, 2008.

Professor R.W. Dalrymple, Department Head, Department of Geological Sciences and Geological Engineering, Queen’s University, Kingston, Ontario, Canada K7L 3N6, Fax: +1-613-533-6592, zarichnyn@geol.queensu.ca

ONE-YEAR FACULTY POSITION
UNIVERSITY OF VERMONT

The Department of Geology at the University of Vermont invites applications for a one-year appointment as a Lecturer beginning in August, 2008 for the Fall 2008 and Spring 2009 semesters. Teaching responsibilities include Earth System Science (Fall 2008) and Earth Hazards (Spring 2009). The fall course includes supervising labs with graduate student Teaching Fellows. Applicants are expected to hold the Ph.D., however qualified ABDs will also be considered. Review of applications begins March 15 and will continue until the position is filled. Applications should be submitted to www.uvmjobs.com and should include a cover letter of application which includes a statement of teaching philosophy, curriculum vitae, and contact information for three references. Further information about the department can be found at http://geology.uvm.edu. The University of Vermont is an Equal Opportunity employer. The University of Vermont is especially interested in candidates who can contribute to the diversity and excellence of the academic community through their research, teaching, and/or service. Applicants are requested to include in their cover letter information about how they will further this goal.

Summer Field Trip

Biking Iceland Geology. I am looking for a companion(s) to tour Iceland 10–14 days this summer. For starters, we could include in places to visit, the itineraries of the 2008 GSA/AWG 2006 field trips. I prefer to go the last half of June, last half of July, or last half of August. Geological sites on roads that may be too rough for moderate bikers can be visited by rented car. Lin Murphy, lmarphy@aol.com, Boulder, Colorado, USA.

THE PETROLEUM INSTITUTE
ABU DHABI, UNITED ARAB EMIRATES

Institution: The Petroleum Institute (PI) was created in 2001 with the goal of establishing itself as a world-class institution in engineering education and research in areas of significance to the oil and gas and the broader energy industries. The PI’s sponsors and affiliates include Abu Dhabi National Oil Company and four major international oil companies. The campus has modern instructional laboratories and classroom facilities and is now in the planning phase of three major research centers on its campus. The PI is affiliated with the Colorado School of Mines, the University of Maryland (College Park), and Leoben and Linz Universities. PI is in the process of developing future working relationships with other major universities and research institutions around the world to capitalize on joint research areas of interest. For additional information, please refer to the PI website: www.pi.ac.ae.

PETROLEUM GEOSCIENCES ENGINEERING POSITIONS

The Petroleum Institute in Abu Dhabi is seeking applications in Petroleum Geosciences Engineering for the following positions:

Program Director
Faculty at all levels
(Chaired and Distinguished Professor, Professor, Associate Professor, Assistant Professor)

Research Associate
Lab Engineer
Post Doc Fellows

Candidates are encouraged to submit applications at the earliest convenience. Review of applications begins upon receipt and positions remain open until successfully filled. Details are available on PI web site: http://www.pi.ac.ae/jobs

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.gsa journals.org

GSA’s online journal.
Stable Isotope science

Isotopes are the keys to knowledge about our past, present and our future. Our isotope analysis services can help you unlock the answers to ecological and environmental history.

For stable isotope analysis of carbon, nitrogen, sulphur, oxygen and hydrogen samples we offer world-leading research scientists whose research spans climate, environmental protection and sustainability, geology, and hydrocarbons research supported by expert technicians.

To know more about benefitting from the expertise of the GNS Science Stable Isotope Laboratory please visit www.gns.cri.nz/nic/stableisotopes or Email us at stableisotopes@gns.cri.nz

Rafter Radiocarbon dating services

When you seek knowledge of “a moment in time” Rafter Radiocarbon can provide the answers. We offer world-leading research scientists whose research spans climate, environmental protection and sustainability, archaeology, and geology, supported by expert technicians.

Working with clients world-wide we have measured over 30,000 samples and we are a regular participant in the International Radiocarbon Intercomparisions conducted by Glasgow University.

To know more about benefitting from the expertise of Rafter Radiocarbon please visit www.rafterradiocarbon.co.nz or Email us at rafter14C@gns.cri.nz