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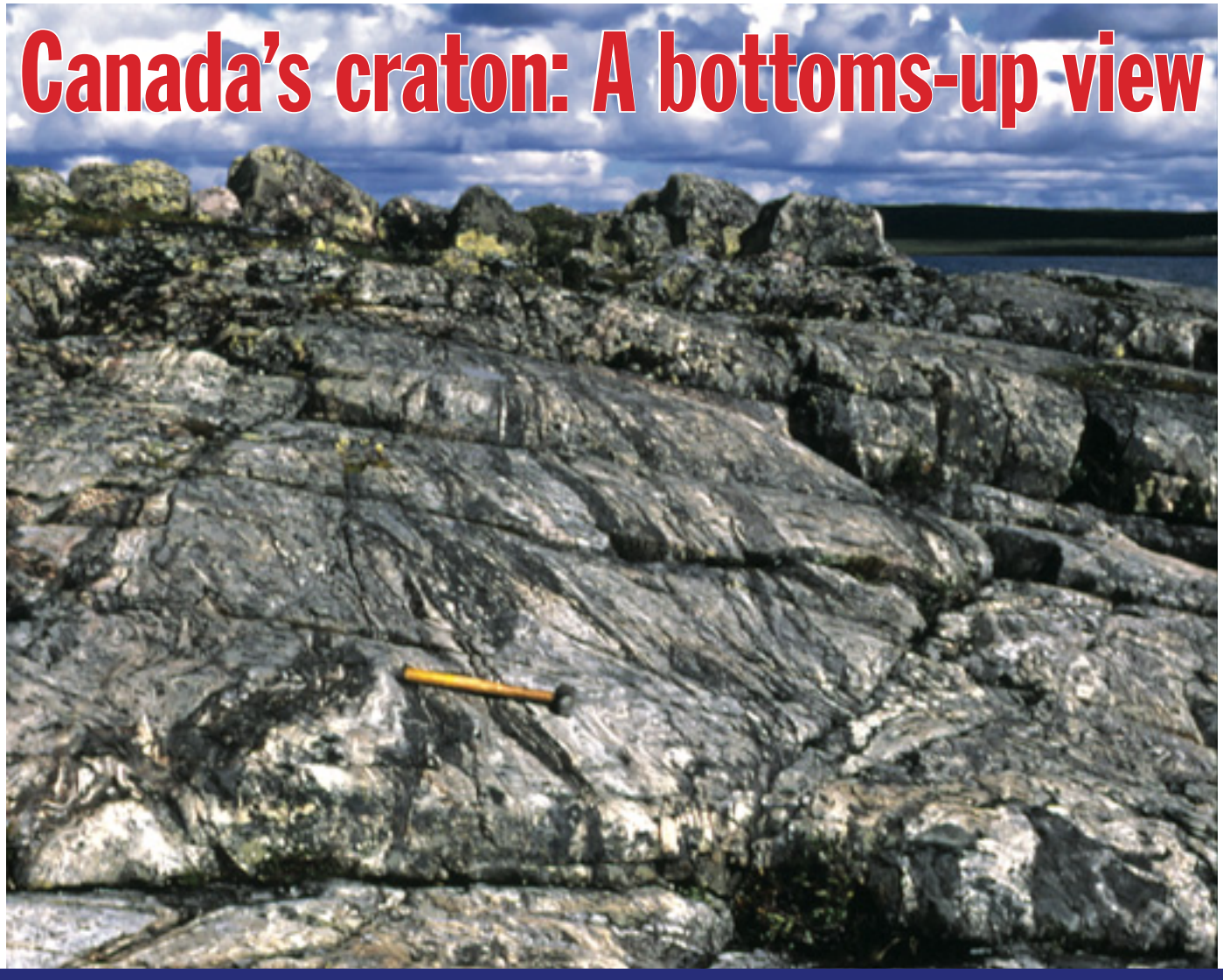

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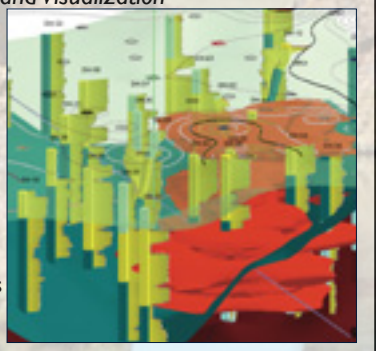

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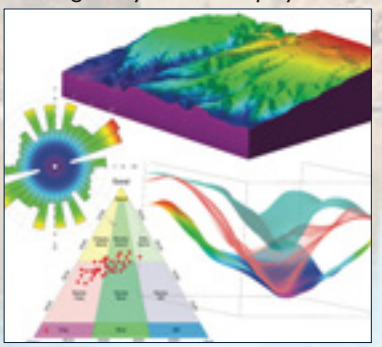

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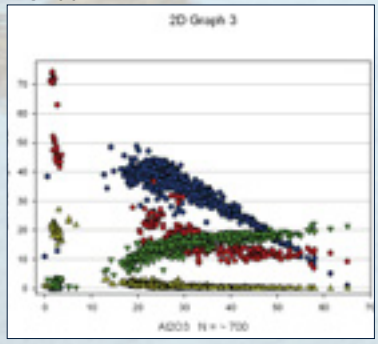

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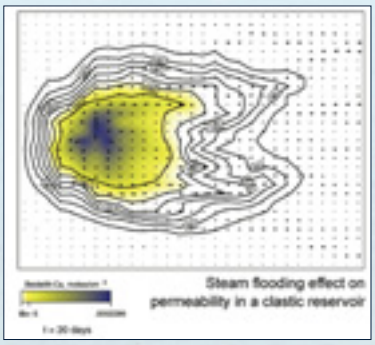

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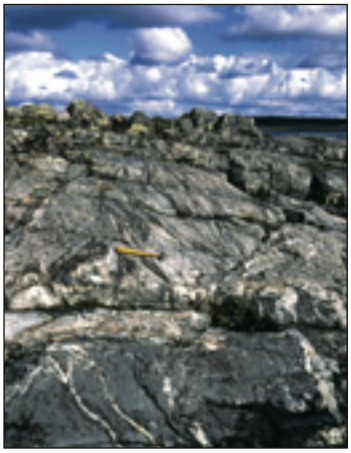
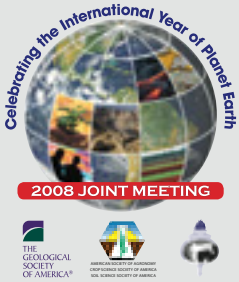
SCIENCE ARTICLE



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. Bleeker, Geological Survey of Canada. See "Canada's craton: A bottoms-up view" by D. Canil, p. 4–10.



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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).

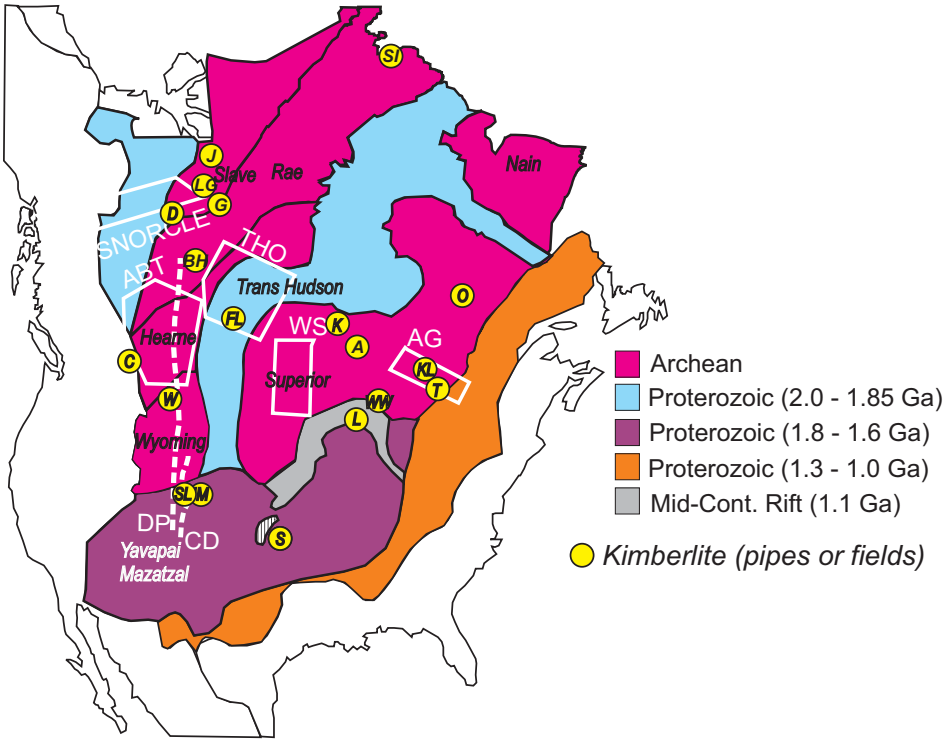

Figure 1. Precambrian basement map of North America stripped of its Phanerozoic sedimentary cover (after Hoffman, 1988, 1990; Ross et al., 1991). Boxes show locations of various geophysical transects within the Lithoprobe program. Also shown are kimberlite fields, clusters, and pipes, clockwise from 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.

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PALEOGEOTHERMS 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 Chapmen, 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 Gahcho 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, ultradepleted layer underlain by a deeper, more fertile layer (Griffin et al., 1999a; Kopylova and Russell, 2000; Kopylova and Caro, 2004). The ultradepleted 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 b.y. (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 $^{187}Os/^{188}Os$ isotopic ratios. Some measure of the minimum age of the lithosphere can be made from $^{187}Os/^{188}Os$ by assuming all Re was lost on melting to produce a "Re depletion age" (T_{RD}) of a sample.

The T_{RD} for kimberlite-borne mantle xenoliths from the Slave, Wyoming, and North Atlantic (Somerset Island) provinces

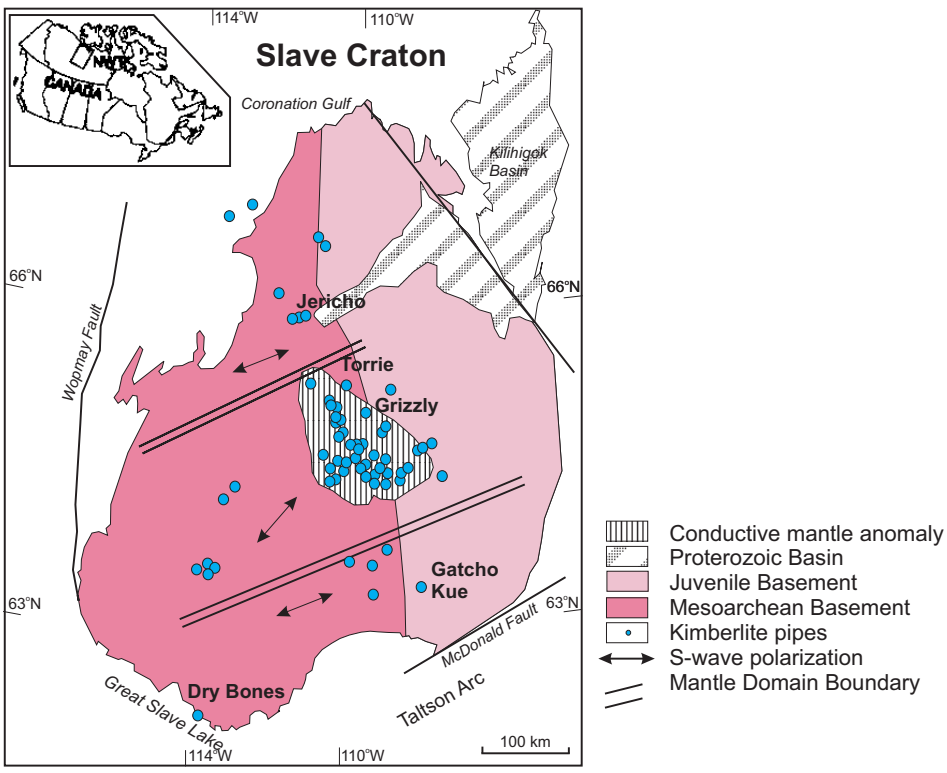

Figure 2. Geological map of the Archean Slave Province (modified after Davis et al., 2003b; Kopylova and Caro, 2004) distinguishing Mesoarchean basement (deeper pink) from more juvenile crust to the east. Also shown are the electrical conductivity anomalies in the central Slave upper mantle (Jones et 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.

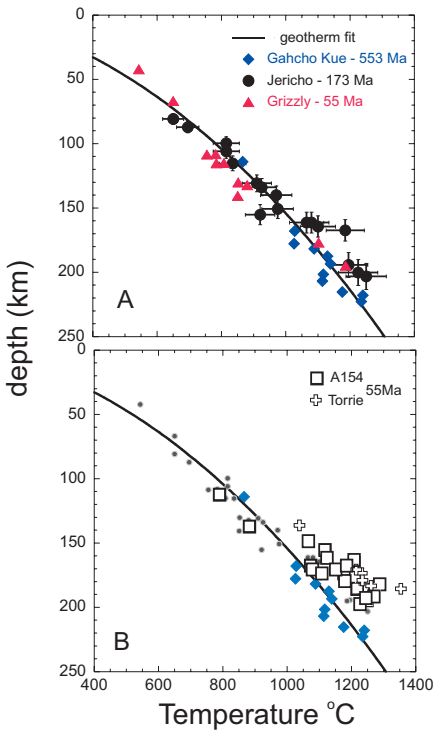

Figure 3. *P-T* arrays for peridotite xenoliths from (A) three kimberlite pipes labeled in Figure 2, with U-Pb ages from 553 to 55 Ma (Heaman et al., 2003) and with analytical data all from the same electron microprobe laboratory (Boyd and Canil, 1997; Kopylova and Caro, 2004; Kopylova et al., 1999). Error bars show uncertainty on temperature and pressure (depth). (B) Same as above compared to *P-T* data from two younger pipes (Aulbach et al., 2007; MacKenzie and Canil, 1999) which may even show a local "warming" mantle compared to those in (A).

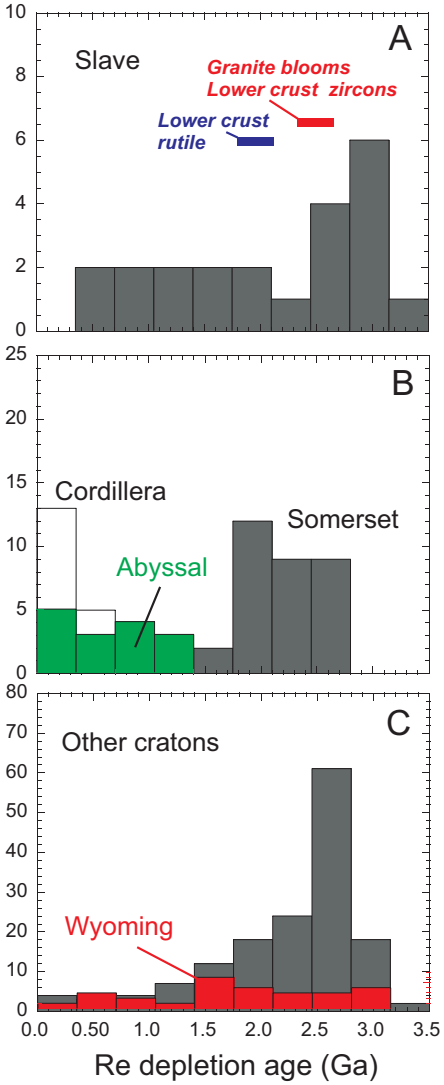

Figure 4. Frequency histograms of Re depletion ages for cratonic xenoliths from (A) Slave Province; (B) Somerset Island, the (off-craton) Canadian Cordillera, and abyssal peridotites; and (C) the Wyoming Province (data from Pearson, 1999; Pearson et al., 2003). Shown for comparison in (A) are U-Pb ages for various events recorded in the crust of the Slave Province: metamorphic zircons and rutile in lower crustal granulite xenoliths, late "granite blooms," and Lu-Hf and U-Pb ages of eclogite xenoliths in the Jericho pipe.

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 Pysklyvec, 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 (Helmstaedt 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 externides 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 in this phase (Brenan et al., 2000), calling into question the validity of diamond ages from sulfide and other inclusions (Navon, 1999). Nonetheless, if the ages are taken at face value, they show that the formation of mantle lithosphere predates its development into a craton "root" below Archean crust by 0.5–1.0 Ga.

TECTONIC SETTING FOR CRATONIC 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

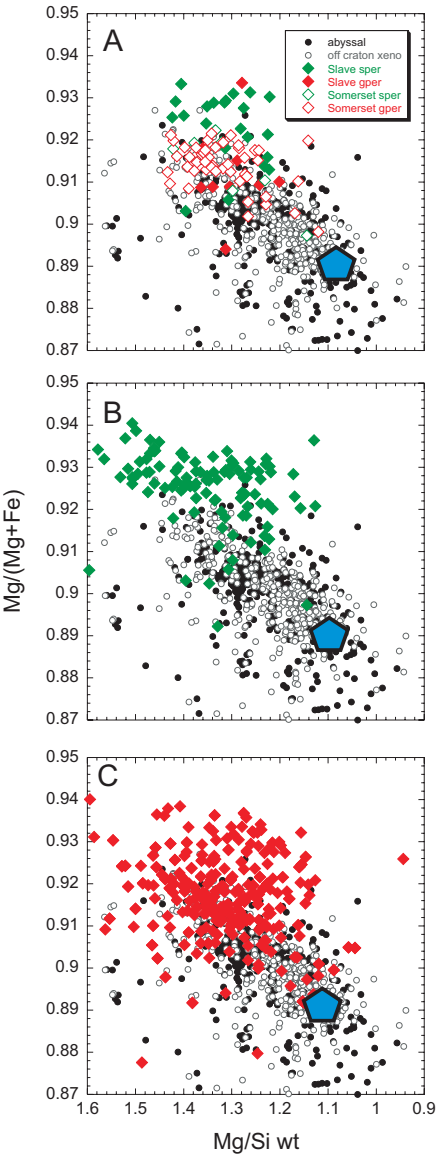

Figure 5. Covariation of Mg/Si with Mg/(Mg + Fe)(Mg#) in whole rock analyses of cratonic peridotite xenoliths compiled by the author (Canil, 2004). The large polygon represents primitive upper mantle peridotite (McDonough and Sun, 1995). (A) Off-craton xenoliths and spinel- and garnet-facies xenoliths (sper, gper) from the Slave Province and Somerset Island. (B) Cratonic spinel-facies. (C) Cratonic garnet-facies xenoliths.

peridotite at any pressure (Walter, 2003), 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).

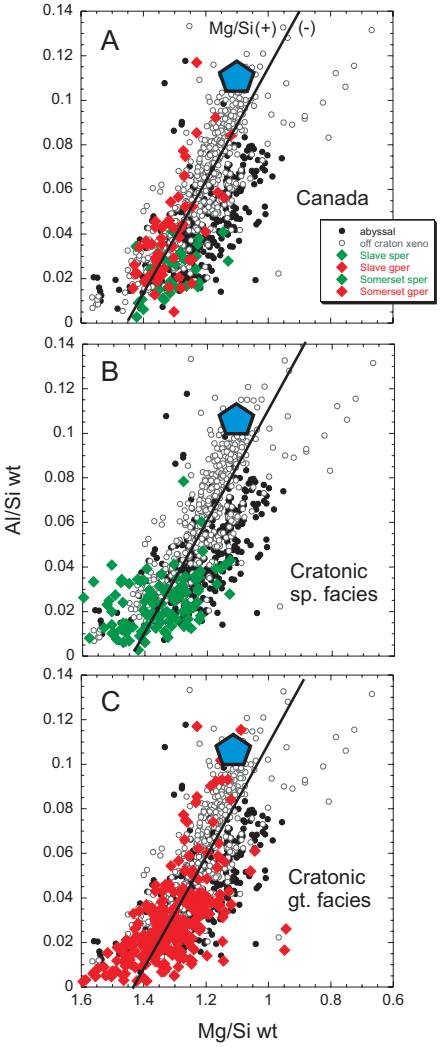

Figure 6. Covariation of Mg/Si with Al/Si in world xenolith data set as in Figure 5. (A) shows the trend for Canadian xenoliths compared with off-craton and abyssal peridotites. The line for all off-craton xenoliths is fitted by least squares to an equation of [Mg/Si] = 1.44(2) – 3.66(11) [Al/Si] (95% 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.

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] = 1.440(8) – 3.66(11) [Al/Si] (r = 0.79, 95% confidence) (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

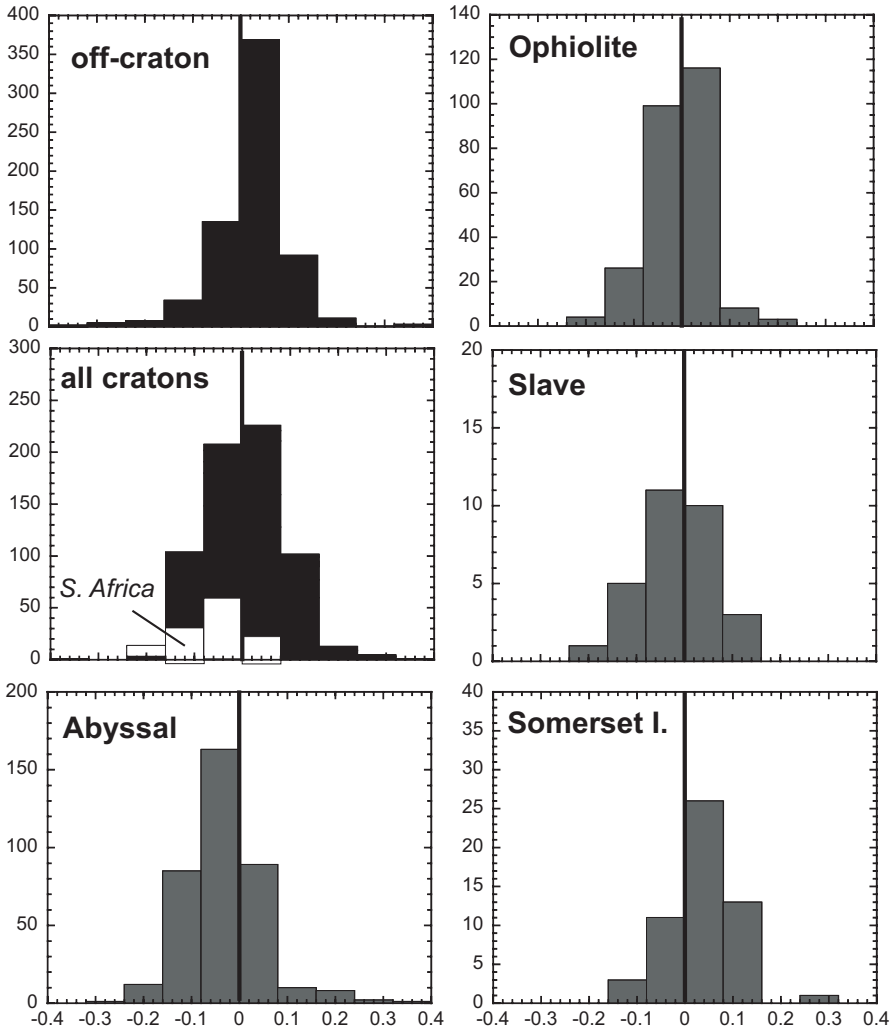

Figure 7. Histograms of ΔMg/Si for peridotites showing the frequency of Si-enrichment relative to the off-craton array (from Fig. 6) in various mantle peridotite types.

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 Fe^{3+} is ten times more incompatible than Fe^{2+} (Canil et al., 1994), melting at higher oxygen fugacity (fO_2) results in a residue with higher Mg/Fe for a given degree of melting. No experimental studies directly investigate the effect of fO_2 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 fO_2. 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

off-craton peridotites (Fig. 5), and the lack of correlation can only occur by melting to near or beyond orthopyroxene exhaustion (~40%) (Bernstein et al., 2007). This means the upper spinel facies portion of cratonic lithosphere was originally a nearly dunitic residue. This trend to extremely depleted lithosphere at the shallowest levels in the lithospheric column beneath cratons is evident in xenolith data sets from the Slave Province (Aulbach et al., 2007; Kopylova and Russell, 2000) and is an almost universal observation in mantle columns constructed from kimberlite-hosted garnet xenocryst suites elsewhere in Canada and throughout the world (Canil et al., 2003; Gaul et al., 2000; Griffin et al., 1999b; Scully et al., 2004). The highly depleted shallow levels of mantle lithosphere beneath Archean provinces provide the compositional buoyancy required 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.

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Comment

Impacts, mega-tsunami, and other extraordinary claims

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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 unsupportable.

1. Karner et al. (2003) reported accretion of extraterrestrial material equaling 2.5×10^9 g yr^{-1}, across 67 m.y.; YDB material, averaging 14.13×10^{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.

[1]Calculations at http://ie.lbl.gov/mammoth/GSAToday.html.

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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.

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eSeis Inc.
Fugro Airborne Surveys
Fugro Robertson Inc.
GETECH
Knowledge Reservoir LLC
Petroleum Geo-Services
Schlumberger/WesternGeco
TGS-NOPEC Geophysical Company
Wood Mackenzie

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
Conviron
Everest Interscience
Innov-X Systems
Phenotype Screening Corporation

Other
Agriculex Inc.
Agrotain 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.

Stevens Water Monitoring Systems Inc.
Subaru of America Inc.
Swift Machine Ltd.
Systea Scientific
UNAVCO
Veris Technologies
Wintersteiger

Planting/Harvesting Supplies and Related Equipment
Kincaid Equipment Manufacturing
NTech Industries Inc.

Professional Societies and Associations
AAPG Foundation
American Association of Stratigraphic Palynologists (AASP)
American Geological Institute
American Geophysical Union
American Institute of Professional Geologists
American Meteorological Society
American Quaternary Association
Association for Women Geoscientists
Association of Women Soil Scientists
Association of American State Geologists
Association of Earth Science Editors
Association of Environmental & Engineering Geologists
Council on Undergraduate Research–Geosciences Division (CUR)
Cushman Foundation
Geochemical Society
Geoinformatics for Geochemistry/ Paleostrat/Marine Geoscience Data System
Geoscience Information Society
Gulf Coast Section SEPM and the GCSSEPM Foundation
International Association of GeoChemistry
Mineralogical Association of Canada
Mineralogical Society of America
National Association of Black Geologists and Geophysicists
National Association of Geoscience Teachers (NAGT)
National Association of State Boards of Geology (ASBOG)
National Cave and Karst Research Institute
National Earth Science Teachers Association (NESTA)
Paleontological Society
Petroleum Technology Transfer Council
Shreveport Geological Society—Host of GCAGS 2009
Sigma Gamma Epsilon
Society for Sedimentary Geology
The Clay Minerals Society
The Palaeontological Association

Publications, Maps, Films
AAPG Bookstore
Allen Press Inc.
Cambridge University Press
Elsevier
Geological Association of Canada
Geomap Company
GeoScienceWorld
Grand Canyon Association
Historic Urban Plans Inc.
Kendall/Hunt Publishing
McGraw-Hill Higher Education
Micropaleontology Project
Mountain Press
Nature Publishing Group
Oxford University Press
Paleontological Research Institution
Pearson Prentice Hall
Springer
Taylor & Francis
University of California Press
W.H. Freeman & Company
W.W. Norton & Company
Waveland Press
Wiley-Blackwell

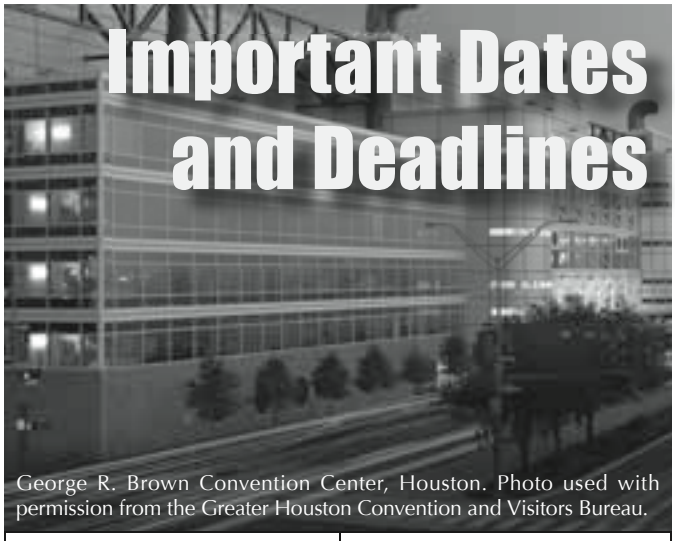
State Surveys
Bureau of Economic Geology
Louisiana Geological Survey

Universities/Schools
Baylor University, Dept. of Geology
Colorado School of Mines
Desert Research Institute
Louisiana State University, Dept. of Geology & Geophysics
Mississippi State University
Paleobiology Database
University of Nevada–Las Vegas
University of Nevada–Reno
University of South Carolina
University of Texas at Austin–Jackson School of Geosciences
University of Texas at San Antonio, Dept. of Geological Sciences
University of Utah, Dept. of Geology and Geophysics
University of Wyoming, Geology & Geophysics Dept.

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.

Important Dates and Deadlines



George R. Brown Convention Center, Houston. Photo used with permission from the Greater Houston Convention and Visitors Bureau.

Early June	Registration and Housing Open
3 June	Abstracts Deadline
14 July	Early Bird Registration Deadline
2 September	Standard Registration and Housing Deadlines
8 September	Registration Cancellation Deadline
Mon.–Sat., 29 Sept.–4 Oct.	Pre-Meeting Field Trips
Fri.–Sun., 3–5 Oct.	Pre-Meeting Short Courses & Workshops
Sat., 4 Oct., 7–9 p.m.	GSA Presidential Address & Awards Ceremony
Sun., 5 Oct., 7–9 p.m.	Welcoming Party & Exhibits Opening
Sun.–Tues., 5–7 Oct.	Employment Service Center
Sun.–noon Thurs., 5–9 Oct.	Oral Sessions
Sun.–Wed., 5–8 Oct.	Poster Sessions (full-day sessions; authors present 4–6 p.m.)
Mon., 6 Oct., 7–9:30 p.m.	Group Alumni Reception
Mon., 6 Oct.	Private Alumni Receptions
Wed., 8 Oct.	Closing Reception
Thurs.–Fri., 9–10 Oct.	Post-Meeting Short Courses & Workshops
Thurs.–Sun., 9–12 Oct.	Post-Meeting Field Trips

THE GEOLOGICAL SOCIETY OF AMERICA®

Field Trips

HOUSTON 2008 JOINT ANNUAL MEETING

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.

The Houston bay area. Image courtesy Greater Houston Convention and Visitors Bureau.

PREMEETING

401. **The Southern Extension of the Western Interior Seaway: Geology of Big Bend National Park and Trans-Pecos, Texas.** Mon.–Sat., 29 Sept.–4 Oct. *Cosponsored by Big Bend National Park.* Roger W. Cooper, Lamar University, Beaumont, Tex.; Dee Ann Cooper, University of Texas, Austin, Tex. Price: US$595 (B, L, R, 6ON).

402. **Platform-Basin Transition and Sequence Stratigraphy of the Permian Rocks, Guadalupe Mountains, west Texas, and southeastern New Mexico.** Wed.–Sat., 1–4 Oct. *Cosponsored by GSA Sedimentary Geology Division; Society of Sedimentary Geology (SEPM).* Michael C. Pope, Washington State University, Pullman, Wash. Price: US$395 (L, R, 3ON). This trip begins and ends in El Paso, Texas.

403. **Sequence Stratigraphy and Reservoir Characteristics of the Booch Sandstones, McAlester Formation (Desmoinesian), Arkoma Basin, Oklahoma.** Thurs.–Fri., 2–3 Oct. *Cosponsored by Oklahoma Geological Survey.* Neil H. Suneson, Oklahoma Geological Survey, Norman, Okla. Price: professionals—US$230; students—US$95 (L, D, R, 1ON). This trip begins and ends in McAlester, Oklahoma.

404. **Fluvial Systems of East-Central Texas: Responses to Climate and Sea-Level Change over the Past Two Glacial-Interglacial Cycles.** Thurs.–Sat., 2–4 Oct. *Cosponsored by GSA Quaternary Geology and Geomorphology Division; GSA Sedimentary Geology Division; Gulf Coast Association of Geological Sciences (GCAGS).* Mike Blum, Louisiana State University, Baton Rouge, La. Price: $US385 (L, R, 2ON).

405. **The Texas Grenville Orogen, Llano Uplift, Texas.** Thurs.–Sat., 2–4 Oct. *Cosponsored by GSA Structural Geology and Tectonics Division.* Sharon Mosher, Jackson School of Geosciences, University of Texas, Austin, Tex. Price: US$270 (B, L, D, R, 2ON). This trip begins and ends in Austin, Texas.

406. **Sedimentology and Structure of Terrestrial to Shallow Marine Outcrops of the Pennsylvanian Mingus Formation, Mineral Wells, Texas.** Thurs.–Sat., 2–4 Oct. *Cosponsored by Houston Geological Society.* Janok P. Bhattacharya, University of Houston, Houston, Tex. Price: US$325 (L, R, 2ON).

407. **Characterization and Interpretation of Soils and Geologic Formations with Carbonates, Gypsum, and Other Soluble Salts.** Thurs.–Sun., 2–5 Oct. *Cosponsored by S-5, S-9, and S-880 of Soil Science Society of America.* Wayne Hudnall, Texas Tech University, Lubbock, Tex. Price: US$395 (L, R, 3ON). This trip begins and ends in Midland, Texas.

408. **Examination of a Vertisol Climosequence across the Texas Coast Prairie and its Implications for Interpreting Vertic Paleosols in the Geologic Record.** Fri.–Sat., 3–4 Oct. *Cosponsored by GSA Sedimentary Geology Division; Division S-5 (Pedology) of Soil Science Society of America; Society of Sedimentary Geology (SEPM).* Lee C. Nordt, Baylor University, Waco, Tex. Price: $US386 (L, 2ON). This trip begins in Corpus Christi, Texas, and ends in Houston, Texas.

409. **Fault Zone Deformation in Cretaceous Carbonates of Central Texas.** Fri.–Sat., 3–4 Oct. *Cosponsored by GSA Structural Geology and Tectonics Division.* David A. Ferrill, Southwest Research Institute, San Antonio, Tex. Price: US$221 (L, R, 1ON).

410. **Birding the Upper Texas Coast.** Sat., 4 Oct. Cyn-Ty Lee, Rice University, Houston, Tex. Price: $US105 (L, R).

411. **Geomorphic and Hydrochemical History of the Edwards Aquifer at Inner Space Cavern.** Sat., 4 Oct. *Cosponsored by GSA Quaternary Geology and Geomorphology Division.* Jay Banner, University of Texas, Austin, Tex. Price: US$150 (L, R). This trip begins and ends in Austin, Texas.

412. **History of Oil and Gas Exploration in Southeast Texas.** Sat., 4 Oct. *Cosponsored by GSA History of Geology Division.* Neal Immega, Houston Gem and Mineral Society, Houston, Tex. Price: $US85 (L, R).

413. **Hands-on at IODP's Gulf Coast Repository—Authentic Scientific Ocean Drilling Samples and Data for Earth Systems Science Inquiry.** Sat., 4 Oct. *Cosponsored by Deep Earth Academy; Consortium for Ocean Leadership; Integrated Ocean Drilling Program; National Science Foundation.* Leslie Peart, Joint Oceanographic Institutions, Washington, D.C. Price: US$163 (B, L, D, R).

414. **The Formation and Future of the Galveston-Follets-Bolivar Barrier System.** Sat., 4 Oct. John Anderson, Rice University, Houston, Tex. Price: US$78 (L, R).

415. **The Origin of the Sandy Mantle and Mima Mounds of the East Texas Gulf Coastal Plain: Geomorphological, Pedological, and Geoarchaeological Perspectives.** Sat., 4 Oct. *Cosponsored by GSA Archaeological Geology Division; GSA Quaternary Geology and Geomorphology Division; Pedology Division (S-5) of the Soil Science Society of America; Council on the History, Philosophy, and Sociology of Soil Science.* Rolfe D. Mandel, Kansas Geological Survey, Lawrence, Kans. Price: $96 (L, R).

416. **Geology of and Hurricane Rita Effects on the Chenier Plain, Southwestern Louisiana.** Sat.–Sun., 4–5 Oct. *Cosponsored by Lamar University; Houston Geological Society.* Donald E. Owen, Lamar University, Beaumont, Tex. Price: US$238 (L, D, R, 1ON).

DURING THE MEETING

417. **A Field Exercise on Groundwater Flow Using Seepage Meters and Mini-Piezometers.** Sun., 5 Oct. David R. Lee, Chalk River Laboratories, Chalk River, Ontario, Canada. Price: US$110 (L, R).

418. **Texas Coastal Systems: K-12 Teachers Trip to Galveston Island and the Brazos River.** Sun., 5 Oct. *Cosponsored by Houston Geological Society and the Region 4 Texas Education Service.* Alison Henning, Rice University, Houston, Tex. Price: FREE (L, R).

419. **Turfgrass Tour of Houston.** Sun., 5 Oct. *Cosponsored by C-5 Turfgrass Science.* Kurt Steinke, Texas A&M University, College Station, Tex. Price: US$100 (L, R).

420. **Kirk Bryan Trip—Coastal Geomorphology and Change along the Upper Texas Coast.** Tues., 7 Oct. *Cosponsored by GSA Quaternary and Geomorphology Division.* Chris Houser, Texas A&M University, College Station, Tex. Price: US$97 (L, R).

421. **Geological and Geophysical R&D in the Oil and Gas Industry: A Tour of ExxonMobil and Shell Research Labs.** Tues., 7 Oct. *Cosponsored by Steve Naruk, Shell International E&P; Lori Summa and Peter Vrolijk, ExxonMobil Upstream Research.* Steve Naruk, Shell International E&P, Houston, Tex. Price: FREE: first come, first served (R).

422. **Come Look at the Rocks: The University of Texas, Bureau of Economic Geology's Houston Research Center.** Tues., 7 Oct. *Cosponsored by Houston Geological Society.* Beverly Blakeney DeJarnett, Bureau of Economic Geology–Houston Research Center, Houston, Tex. Price: US$50 (R).

423. **Dealing with Active Gulf Coast Growth Faults.** Wed., 8 Oct. *Cosponsored by Houston Geological Society.* Carl E. Norman, Houston Geological Society, Houston, Tex. Price: $US112 (L, R).

424. **From Oilfields to Cornfields, and a Lot More.** Wed., 8 Oct. *Cosponsored by American Society of Agronomy Divisions A-9 and A-7.* Michael Stewart, International Plant Nutrition Institute, San Antonio, Tex. Price: US$50 (L, R).

425. **Rice Tec and Oilfields to Corn Fields and a Lot More.** Wed., 8 Oct. *Cosponsored by American Society of Agronomy Divisions A-7 and A-9.* Steve Norberg, Oregon State University, Ontario, Ore. Price: US$62 (L, R).

POSTMEETING

426. **Environments of Deposition of Texas Lignites: The Good, the Bad, the Ugly.** Thurs., 9 Oct. *Cosponsored by Houston Geological Society.* Christopher Mathewson, Texas A&M University, College Station, Tex. Price: US$96 (L, R).

427. **Sedimentology and Stratigraphy of Modern Coastal Plain Depositional System (Students Only).** Fri.–Sat., 10–11 Oct. *Cosponsored by Shell International Exploration and Production Inc.* John Anderson, Rice University, Houston, Tex. Price: US$50 (L, R, 1ON).

428. **Revisiting Central Texas Late Cambrian Wilberns Stromatolites and Thrombolites.** Thurs.–Sat., 9–11 Oct. André Willy Droxler, Rice University, Houston, Tex. Price: US$398 (L, R, 2ON).

429. **Soils and Geomorphology of the Texas Gulf Coastal Plain and Texas Shoreline with Special Emphasis on Hydrology and Coastal Erosion.** Thurs.–Sat., 9–11 Oct. *Cosponsored by SSSA Division of S-5 (Pedology); SSSA S880 Soils-Geomorphology Committee; GSA Quaternary Geology and Geomorphology Division.* C.T. Hallmark, Texas A&M University, College Station, Tex. Price: $372 (L, R, 2ON).

430. **The Edwards Aquifer of South-Central Texas.** Thurs.–Sat., 9–11 Oct. *Cosponsored by Edwards Aquifer Authority; Southwest Research Institute; National Cave and Karst Research Institute; LBG-Guyton Associates; University of Minnesota.* Geary M. Schindel, Edwards Aquifer Authority, San Antonio, Tex. Price: $US332 (L, R, 2ON). This trip begins in Houston, Texas, and ends in San Antonio, Texas.

431. **The Sierra Madera Astrobleme, Pecos County, Texas.** Thurs.–Sat., 9–11 Oct. *Cosponsored by Houston Geological Society.* David A. Kring, Lunar and Planetary Institute, Houston, Tex. Price: US$405 (L, R, 2ON). This trip begins and ends in Midland, Texas.

432. **Upper Cambrian through Lower Ordovician Rocks of the Llano Region.** Thurs.–Sun., 9–12 Oct. *Cosponsored by West Texas Geological Society.* Emilio Mutis-Duplat, University of Texas of the Permian Basin, Odessa, Tex. Price: US$526 (L, D, R, 3ON).

433. **Searching for the Mojave-Sonora Megashear in Northeastern Mexico.** Fri.–Sun., 10–12 Oct. *Cosponsored by GSA Structural Geology and Tectonics Division.* Gary G. Gray, ExxonMobil Upstream Research Company, Houston, Tex. Price: US$353 (L, D, R, 2ON). This trip begins and ends in Monterrey, Mexico.

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

501. **Estimating Rates of Groundwater Recharge.** Sat., 4 Oct., 8 a.m.–5 p.m. Rick Healy, USGS; Bridget Scanlon, Univ. of Texas. Limit: 35. Fee: US$191; includes lunch. CEU: 0.8.

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.

502. **Geopressure and Pore Pressure Prediction Fundamentals.** Sat., 4 Oct., 8 a.m.–5 p.m. *Cosponsored by Gulf Coast Association of Geological Sciences (GCAGS).* Selim S. Shaker, Geopressure Analysis Services Inc. Limit: 30. Fee: US$160; includes lunch. CEU: 0.8.

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.

503. **How to QC and Interpret What Your Petrophysicist Gives You.** Sat., 4 Oct., 8 a.m.–5 p.m. *Cosponsored by GCAGS; Fugro-Jason.* Elizabeth Fisher, Hess Corp.; Jeff Baldwin, Fugro-Jason; Tad Smith. Limit: 25. Fee: US$160; includes lunch. CEU: 0.8.

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 efisher@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.

505. **Introduction to Geographic Information Systems (GIS) Using ArcGIS for Geological and Environmental Science Applications.** Sat.–Sun., 4–5 Oct., 8 a.m.–5 p.m. *Cosponsored by ESRI.* Ann Johnson, ESRI; Mike Price, ESRI; Willy Lynch, ESRI. Limit: 20. Fee: US$45; includes lunch and 6-month software. CEU: 1.6.

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.

506. **Seal Analysis Workshop.** Sat., 8 a.m.–5 p.m., and Sun., 8 a.m.–4 p.m., 4–5 Oct. *Cosponsored by GCAGS.* William C. Dawson, Chevron; William R. Almon, Chevron. Limit: 40. Fee: US$320; includes lunch. CEU: 1.5.

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.

507. **Ethics for Geoscientists.** Sat., 4 Oct., noon–1 p.m. *Cosponsored by GCAGS*; *Houston Geological Society*. Chris Mathewson, Texas A&M. Limit: 150. Fee: US$40 with lunch; US$30 without lunch. CEU: 0.1.

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 S5 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.

509. **Parameter Estimation and Uncertainty Analysis Course.** Thurs., 5 p.m.–9 p.m.; Fri., 8 a.m.–5 p.m., 9–10 Oct. *Cosponsored by California Groundwater Resources Association.* Matthew Tonkin, SS Papadopulos & Associates; John Doherty, Watermark Numerical Computing. Limit: 20. Fee: US$425; includes lunch, software, and numerous publications. CEU: 1.2.

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.

FACULTY AND GRADUATE STUDENT COURSES

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.

511. **3-D Visualization in Teaching and Research.** Fri., 3 Oct., 8 a.m.–5 p.m. *Cosponsored by Landmark/Halliburton.* Bill Keach, Brigham Young Univ. and Univ. of Utah–Energy and Geoscience Institute; John McBride, Brigham Young Univ. Limit: 24. Fee: US$93; includes lunch. CEU: 0.8.

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.

PENROSE MEDAL

ARTHUR L. DAY MEDAL

YOUNG SCIENTIST AWARD
(DONATH MEDAL)

PRESIDENT'S MEDAL

GSA PUBLIC SERVICE AWARD

GSA DISTINGUISHED SERVICE AWARD

BROMERY AWARD FOR THE MINORITIES

AGI MEDAL IN MEMORY OF IAN CAMPBELL

HONORARY FELLOWS

SUBARU OUTSTANDING WOMAN IN SCIENCE AWARD

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.

513. **Education Research I: Conducting Qualitative Geoscience Education Research.** Sat., 4 Oct., 8 a.m.–noon. Julie Sexton, NSF Center for Learning and Teaching in the West, Colorado State Univ. Limit: 50. Fee: US$103. CEU: 0.4.

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://earthednet.org/lwd/.

515. **Teaching Darwin.** Sat., 4 Oct., 9 a.m.–noon. *Cosponsored by GSA History of Geology Division*. Leo F. Laporte, Univ. of California at Santa Cruz. Limit: 50. Fee: US$70. CEU: 0.4.

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 Pomeroy, 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.

517. **Multi- and Hyperspectral Remote Sensing for Geologic Applications.** Sat., 4 Oct., 8 a.m.–5 p.m. William Farrand, Space Science Institute; John Mars, USGS. Limit: 30. Fee: US$208. CEU: 0.8.

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 Literacies 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.

521. **Making the Case for Tenure: A Workshop for Early Career Faculty.** Sat., 4 Oct., 9 a.m.–5 p.m. *Cosponsored by On the Cutting Edge*; *GSA Geoscience Education Division; National Association of Geoscience Teachers.* Kristen St. John, James Madison Univ.; Heather Macdonald, College of William and Mary. Limit: 35. Fee: US$50. CEU: 0.7.

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.

523. **Writing and Evaluating Geoscience Concept Inventory Questions.** Sat., 4 Oct., 9 a.m.–5 p.m. *Cosponsored by National Science Foundation.* Julie Libarkin, Michigan State Univ.; Steven W. Anderson, Univ. of Northern Colorado. Limit: 50. Fee: US$10; includes continental breakfast. CEU: 0.7.

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.

524. **An Introduction to Improving Your Teaching by Conducting Science Education Research in Your Classroom.** Sat., 4 Oct., 1–5 p.m. *Cosponsored by NASA.* Tim Slater, Univ. of Wyoming; Julie Libarkin, Michigan State Univ.; Stephanie Slater, Univ. of Wyoming. Limit: 40. Fee: US$14. CEU: 0.4.

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.*

525. **Education Research II: Conducting Quantitative Geoscience Education Research.** Sat., 4 Oct., 1–5 p.m. Julie Sexton, NSF Center for Learning and Teaching in the West, Colorado State Univ.; James J. Dugan, Research and Development Center for the Advancement of Student Learning, Colorado State Univ. and Poudre School District. Limit: 50. Fee: US$103. CEU: 0.4.

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."

All students are invited to the

Houston 2008 Joint Annual Meeting

Society Presidents' Student Breakfast Reception

Sunday, 5 Oct., 7–8:30 a.m.
Location TBA

Sponsored by ExxonMobil

Hosted by GSA, SSSA, ASA, CSSA, GCAGS, and HGS

The GSA, SSSA, ASA, CSSA, GCAGS, and HGS presidents invite all registered students to attend a free breakfast buffet sponsored by ExxonMobil Corp. Leading members of each society, along with ExxonMobil staff members, will be on hand to answer questions and address student issues.

Each student registered for the meeting will receive a complimentary ticket for the breakfast buffet.

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.

527. **Your First Steps in the Profession and the Future.** Sat., 4 Oct., 1–5 p.m. *Cosponsored by American Institute of Professional Geologists (AIPG); Northeast Section, AIPG.* Robert A. Stewart, LFR Inc.; Raymond Talkington, Geosphere Environmental Management Inc. Limit: 50. Fee: US$25. CEU: 0.4.

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.

530. **Teaching Introductory Geoscience Using Lecture Tutorials.**
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 worksheets 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.

532. **Structural and Stratigraphic Concepts Applied to Basin Exploration.**
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.

GSA's 2008 Hall of Fame

Houston 2008 Joint Annual Meeting

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.

THE GEOLOGICAL SOCIETY OF AMERICA®

USGS science for a changing world

Houston 2008 Joint Annual Meeting

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:

❶ Go to **www.acsmeetings.org/2008/**;

❷ Click on "Program" then "Events";

❸ Click on "Plan Your Event";

❹ 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.

THE GEOLOGICAL SOCIETY OF AMERICA®

Don't wait until the last minute.

Short Courses continued from p. 20.

K–12 TEACHER COURSES

533. **More! Rocks in Your Head: Earth Science Professional Development for Teachers Grades 3–8 (K–12 welcome).** Fri., 3 Oct., 8 a.m.–4:30 p.m. *Cosponsored by the Ellison Miles Geotechnology Institute; American Association of Petroleum Geologists; Houston Geological Society; Region 4 Texas Education Service Center.* Janie Schuelke, Consultant. Limit: 60. No fee; lunch provided. CEU: 0.8.

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)

Houston with Buffalo Bayou in the foreground, courtesy www.visithoustontexas.com/media/image_gallery.php.

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.

536. **Epigenic and Hypogenic Karst: Recognizing Each and Their Implications in Research and Management.** Sat., 4 Oct., 8 a.m.–noon. *Cosponsored by National Cave and Karst Research Institute (NCKRI).* George Veni, NCKRI; Kevin Stafford, Stephen F. Austin University. Limit: 50. Fee: US$112. CEU: 0.4.

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 bambachr@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, isotope 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.

K–12 Education Events

HOUSTON 2008 JOINT ANNUAL MEETING

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.

515. **Teaching Darwin.** Sat., 4 Oct., 9 a.m.–noon. *Cosponsored by GSA History of Geology Division.* Leo F. Laporte, Univ. of California at Santa Cruz. Limit: 50. Fee: US$70. CEU: 0.4.

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GSA Mentor Programs

Find full program descriptions at
www.geosociety.org/science/.
For additional information, contact Jennifer Nocerino
jnocerino@geosociety.org.

WOMEN IN GEOLOGY

Sun., 5 Oct., noon–1:30 p.m.

SUBARU

This new mentoring program, sponsored by Subaru, will address the issues faced by women in geology. This social hour begins with a few key women speakers, followed by a relaxing forum for socializing, sharing ideas, and meeting other women in geology. Appetizers will be provided. Registration is not required.

GEOLOGY IN GOVERNMENT

Mon., 6 Oct., 11:30 a.m.–1 p.m.

FREE lunch for undergraduate and graduate students. This popular annual event features a select panel of mentors representing various government agencies who will invite questions from students, offer advice about preparing for a career, and comment on the prospects for current and future job opportunities within their agencies. Registration is not required.

GEOLOGY IN INDUSTRY

Tues., 7 Oct., 11:30 a.m.–1 p.m.

FREE lunch for undergraduate and graduate students. This event features a select panel of mentors representing various industries who invite questions from the students, offer advice about preparing for a career in industry, and comment on the prospects for current and future job opportunities within their companies. Registration is not required.

JOHN MANN MENTORS IN APPLIED HYDROGEOLOGY PROGRAM

This program underwrites the cost for up to 25 students to attend the distinguished Hydrogeology Division Luncheon and Awards Presentation. **Eligible students are those who have (1)** checked the box on their membership application indicating their professional interest in hydrology/hydrogeology, AND **(2)** registered for the 2008 Joint Annual Meeting **by 2 Sept. 2008.** The lucky ticket recipients will have the chance to meet with some of the nation's most distinguished hydrogeologists. Tickets will be awarded to the first 25 students who respond to an **e-mail invitation**, based on the eligibility criteria above. Date TBA. **Registration required.**

THE GEOLOGICAL SOCIETY OF AMERICA®

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THE GEOLOGICAL SOCIETY OF AMERICA®

Attention All Student Members!

Save money and attend the 2008 Joint Meeting in Houston!

Become a Student Volunteer

You will earn

- FREE registration by volunteering 10 hours.
- A FREE *Abstracts with Programs* by volunteering 15 hours.
- A US$25 stipend for every five hours that you volunteer.

For more information, contact Eric Nocerino
enocerino@geosociety.org, +1-303-357-1060.

CAREER PLACEMENT

*Looking for **QUALIFIED CANDIDATES?***

*Looking for **EMPLOYMENT?***

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.

THE GEOLOGICAL SOCIETY OF AMERICA®

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.

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/ncgrant.htm
South-Central: www.geosociety.org/sectdiv/southc/index.htm#travel
Northeastern: www.geosociety.org/grants/negrant.htm
Southeastern: core.ecu.edu/geology/neal/segsa/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/.**

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 tourguide 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.

103. **Chinatown Dim Sum Lunch & Chinese Supermarket Tour.** 11 a.m.–3 p.m. Cost: US$54. Min.: 20. Start with a sumptuous dim sum lunch at the Ocean Palace Restaurant. Following lunch, tour the Hong Kong City Mall (second largest Asian mall in the U.S.).

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 Artiste.

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/.

2008 Tyler Prize

Professor James N. Galloway

Department of Environmental Sciences,
University of Virginia

Professor Harold A. Mooney

Department of Biological Sciences,
Stanford University

Tyler Prize

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.

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.

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 Yoel Margalith, for Environmental Medicine and Public Health

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

Members of the Tyler Prize Executive Committee

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*
Dr. Judith E. McDowell, *Woods Hole Oceanographic Institution*
Dr. Ralph Mitchell, *Harvard University*
Dr. F. Sherwood Rowland, *University of California, Irvine*
Dr. Jonathan M. Samet, *The Johns Hopkins University*
Dr. Cornelius W. Sullivan, *University of Southern California*

THE GEOLOGICAL SOCIETY OF AMERICA®

FREE Research Proposal Writing Workshop

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.

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.

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.

P1. Breakthroughs in Paleontology: The Paleontological Society Centennial Symposium. Mon., 6 Oct., 8 a.m.–noon.

Cosponsored by *Paleontological Society; Cushman Foundation; GSA Geobiology and Geomicrobiology Div.; GSA Geoscience Education Div.; GSA History of Geology Div.; Paleontologic Research Institute.* Scientific Categories: Paleontology, Diversity, Extinction, Origination; History of Geology; Paleoclimatology/Paleoceanography.

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.

P2. Critical Zone Studies of Soils and Weathering: Implications for Interpreting Climate and Landscapes of the Past. Mon., 6 Oct., 1:30–5:30 p.m.

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.

P3. Energy, Water, Soil, and Crops: Status and Challenges for 2050. Wed., 8 Oct., 8 a.m.–noon.

Cosponsored by *GSA Geology and Society Div.; C3 Crop Ecology, Management & Quality.* Scientific Categories: Public Policy; Environmental Geoscience.

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.

P5. Perspectives on an Emerging Workforce Crisis in Geology: Assessing a Looming Irony. Sun., 5 Oct., 8 a.m.–noon.

Scientific Categories: Public Policy; Geoscience Information/Communication; Geoscience Education.

John Holbrook, Univ. of Texas, Arlington, Tex. Kevin Bohacs, ExxonMobil Upstream Research Co., Houston, Tex.

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.

P6. Return to the Moon: A New Era of Lunar Exploration. Sun., 5 Oct., 1:30–4:45 p.m.

Cosponsored by *GSA Planetary Geology Div.* Scientific Categories: Planetary Geology; Volcanology; Tectonics.

Louise Prockter, Applied Physics Laboratory, Johns Hopkins Univ., Laurel, Md.; Jeffrey Plescia, Applied Physics Laboratory, Johns Hopkins Univ., Laurel, Md.

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

A Celebration of Soil Science, Solute Transport, and National-Scale Water-Quality Research: In Honor of Jacob Rubin. Cosponsored by *GSA Hydrogeology Div.; S01 Soil Physics.*

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.*

Can Wetland Functions Be Meaningfully Characterized from Landscape Position, Climatic Settings, and other Proxy Data? Cosponsored by *GSA Hydrogeology Div.; GSA Geology and Society Div.; S10 Wetland Soils.*

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; S05 Pedology; GSA Geoinformatics Div.*

Connecting the Dots: Linking Energy and Mass Balance to Soil Morphologic and Stratigraphic Processes. Cosponsored by *GSA Hydrogeology Div.; GSA Quaternary Geology and Geomorphology Div.; S01 Soil Physics; S05 Pedology.*

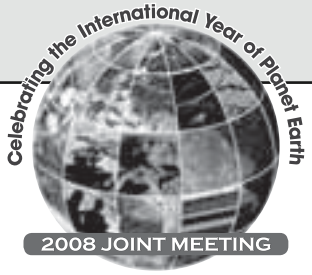
Desert Pavements and Vesicular A Horizons (Posters). Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; S05 Pedology.*

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.*

Emerging Contaminants in Water, Soils, and Sediments: Sources, Pathways, Interactions, and Ecological Impacts. Cosponsored by *GSA Hydrogeology Div.; National Ground Water Association–Association of Ground Water Scientists and Engineers; A05 Environmental Quality; Gulf Coast Association of Geological Societies.*

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.

SUNDAY, 5 OCT.

Morning: Climate Change through Time: Evidence in the Geologic Record.

Afternoon: The Impending Global Water Crisis: Geology, Soils, Agronomy, and International Security. *E.T. and Vam York Distinguished ASA Lectureship.*

MONDAY, 6 OCT.

Morning: Energy Budgets and the Global Market. *CSSA Betty Klepper Endowed Lectureship.*

Afternoon: Globalization of Biogeochemical Cycles. *GSA Pardee Lecture.*

TUESDAY, 7 OCT.

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

Afternoon: Coastal Impacts: Can Massive Environmental Restoration and Coastal Engineering Protect the Gulf Coast from Future Hurricane Impacts and Rising Sea Levels? *SSSA William H. Patrick Jr. Memorial Lectureship.*

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.*

Energy from Renewables Using Soil Microbes and Microbial Processes. Cosponsored by *GSA Hydrogeology Div.; S03 Soil Biology & Biochemistry.*

Gains and Losses: Soil Nutrients and Moisture in Aridic Soils Under Changing Climates. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; S06 Soil & Water Management & Conservation; S05 Pedology.*

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 Subsidence Attributable to Subsurface Fluid Extraction in Coastal Lowlands: Contributions to Relative Sea-Level Rise. Cosponsored by *GSA Hydrogeology Div.; GSA Structural Geology and Tectonics Div.; National Ground Water Association, Association of Ground Water Scientists and Engineers; Harris-Galveston Subsidence District; U.S. Geological Survey Subsidence Interest Group; 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.*

Role of Metals, Minerals, and Microbes in Urban Development and Maintenance. Cosponsored by *S03 Soil Biology & Biochemistry; GSA Engineering Geology Div.*

Scale and Accuracy in Estimating Water Balance. Cosponsored by *GSA Hydrogeology Div.; A03 Agroclimatology & Agronomic Modeling.*

Scaling Methods in Hydrological Research. Cosponsored by *GSA Hydrogeology Div.; S01 Soil Physics.*

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.*

U.S. Agriculture's Role in Soil Carbon Sequestration and Greenhouse Gas Mitigation (GRACEnet). Cosponsored by *GSA Geobiology and Geomicrobiology Div.; S03 Soil Biology & Biochemistry; S06 Soil & Water Management & Conservation.*

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

GC1. Energy Budgets and the Global Market. Cosponsored by *American Geological Institute.*

GC2. Applied Micropaleontology: Tools and Techniques for the 21st Century. Cosponsored by *Cushman Foundation for Foraminiferal Research; Paleontological Society; Gulf Coast Association of Geological Societies; Society for Sedimentary Geology (SEPM); Paleontological Research Institute.*

GC3. Shale Gas.

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.

GC7. Faults: Friend and Foe.

GC8. Allochthonous Salt: Impact from Exploration to Production.

GC9. Visualization of Depositional Systems.

GC10. Predictive Models for Deep-Water Reservoir Distributions: The Subsalt Challenge.

GC11. Old Fields—New Life: How New Technologies or New Ideas Have Made a Difference. Cosponsored by *GSA Structural Geology and Tectonics Div.; Gulf Coast Association of Geological Societies.*

GC12. Advances in Seismic Imaging—Impact on Exploration through Production: Case Studies.

GC13. Depositional Systems: Insights from Outcrops, Shallow Seismic or Coastal Studies.

GC14. Uncertainty Assessment and its Impact on Decision Making.

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

GC16. Environmental Geology and Hydrology.

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.

T1. Response of Coastal Environments to Accelerated Sea-Level Rise. Cosponsored by *Paleontological Society; Gulf Coast Association of Geological Societies; GSA Quaternary Geology and Geomorphology Div.; GSA Geology and Society Div.; Gulf Coast Association of Geological Societies.*

T2. Coastal and Aeolian Geomorphology Processes and Landforms. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.*

T3. The Coastal Zone—The Air-Land-Sea Interface, Where People Like to Live. Cosponsored by *GSA Engineering Geology Div.; Gulf Coast Association of Geological Societies.*

T4. Oceanic Geohazards: Distribution, Controls, and Risks. Cosponsored by *Gulf Coast Association of Geological Societies.*

T5. Coastal Tectonics of the Pacific Rim: Geomorphology, Structure, and Hazards. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; GSA Structural Geology and Tectonics Div.*

T6. Estuarine and Fjord Sedimentary Processes in Modern and Holocene Systems. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; Gulf Coast SEPM; Gulf Coast Association of Geological Societies.*

T7. The Mississippi River Delta Plain as a Natural Laboratory for Evaluating Forcing Mechanisms and Coastal Response to Rapid Relative Sea-Level Rise, Development of Transgressive Stratigraphic Models, and Innovations in Transgressive Coastal Management. Cosponsored by *U.S. Geological Survey; Louisiana Department of Natural Resources; Pontchartrain Institute for Environmental Sciences; New Orleans Geological Society; GSA Sedimentary Geology Div.; Gulf Coast Association of Geological Societies.*

T8. Late Quaternary of the Northern Gulf of Mexico Margin: Climate Change, Sea-Level Change, and the Depositional Record. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; GSA Sedimentary Geology Div.*

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.*

T10. Ancient Polar Ecosystems and Environments: Proxies for Understanding Climate Change and Global Warming. Cosponsored by *Paleontological Society; Gulf Coast Association of Geological Societies.*

T11. Global Warming Science: Implications for Geoscientists, Educators, and Policy Makers. Cosponsored by *GSA Geoscience Education Div.; The American Quaternary Association (AMQUA); GSA Geology and Health Div.; GSA Geology and Society Div.; GSA Quaternary Geology and Geomorphology Div.; National Association of Geoscience Teachers; Gulf Coast Association of Geological Societies.*

T12. Channel Networks as a Template for Earth and Environmental Processes: Toward an Integrative Process Model for Landscape Evolution. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; National Center for Earth Dynamics.*

T13. Sediment in Fluvial Systems: Production, Transport, and Storage at the Watershed Scale. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.*

T14. Wood Debris and the Morphology of Alluvial Landscapes. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; GSA Engineering Geology Div.; Gulf Coast Association of Geological Societies.*

T15. Trends in Geomorphology: Advances and Innovations in Measurement and Analysis. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; Gulf Coast Association of Geological Societies.*

T16. River Response to Climate Change. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; GSA Engineering Geology Div.; 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.*

T18. Soil Geomorphology and Chronosequences. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; S05 Pedology; Gulf Coast Association of Geological Societies.*

T19. Loess and Loess Soils. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; Gulf Coast Association of Geological Societies.*

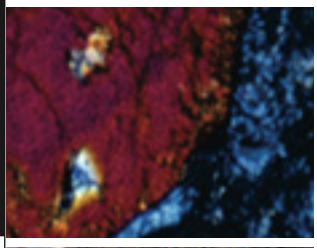
T20. Assessment of Speleothem Paleoenvironment Proxies Using Studies in Modern Karst Systems. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; Gulf Coast Association of Geological Societies.*

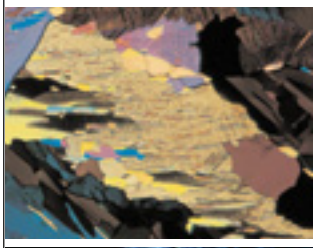
T21. Lakes, Playas, and Soils. Cosponsored by *GSA Limnogeology Div.; GSA Quaternary Geology and Geomorphology Div.; GSA Sedimentary Geology Div.*

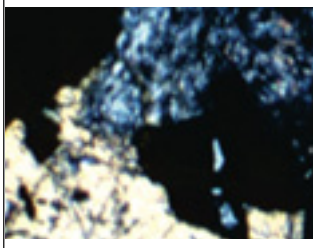
T22. Lacustrine, Palustrine, Wetlands, and Ponds: Important Distinctions, Useful Criteria. Cosponsored by *GSA Limnogeology Div.; GSA Sedimentary Geology Div.; Society for Sedimentary Geology (SEPM); Gulf Coast Association of Geological Societies.*

T23. Terrestrial Authigenic Minerals: Modern Processes and Ancient Deposits. Cosponsored by *GSA Limnogeology Div.; Sedimentary Geology Div.; Gulf Coast Association of Geological Societies.*

T24. Lakes in Extreme Environments: Earth and Beyond. Cosponsored by *GSA Limnogeology Div.; Gulf Coast Association of Geological Societies.*







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T25. Terrestrial Response to Climate Variability during the Medieval Warm Period: Lakes, Tree-Rings, and Human Adaptation. Cosponsored by *GSA Limnogeology Div.; GSA Quaternary Geology and Geomorphology Div.; GSA Archaeological Geology Div.*

T26. Lake Cores: Climate Change and Tectonics (Posters). Cosponsored by *GSA Limnogeology Div.; GSA Structural Geology and Tectonics Div.*

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.*

T28. Permian and Triassic Terrestrial Biotic Responses to Global Perturbations. Cosponsored by *GSA Sedimentary Geology Div.; The Paleontological Society; Society for Sedimentary Geology (SEPM); 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.*

T30. River-Dominated Continental Margin Processes: Modern and Ancient. Cosponsored by *GSA Sedimentary Geology Div.; Gulf Coast Section SEPM; GSA Quaternary Geology and Geomorphology Div.; Gulf Coast Association of Geological Societies.*

T31. The Future of Sedimentary Geology: Student Research (Posters). Cosponsored by *Society for Sedimentary Geology (SEPM); Gulf Coast Association of Geological Societies.*

T32. Mixed Siliciclastic-Carbonate Systems: Mixing through Time and Space. Cosponsored by *GSA Sedimentary Geology Div.; Society for Sedimentary Geology (SEPM); Gulf Coast Association of Geological Societies.*

T33. Mesozoic Sedimentary Basins as Archives of Mexican Magmatic History and Paleogeography. Cosponsored by *GSA Sedimentary Geology Div.; 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.*

T35. Paleozoic Oceanographic and Climatic Changes: Evidence from Seawater Geochemistry and Sedimentology Records. Cosponsored by *Gulf Coast Association of Geological Societies.*

T36. The Astronomically Forced Sedimentary Record: From Geologic Time Scales to Lunar-Tidal History. Cosponsored by *GSA Sedimentary Geology Div.; Gulf Coast Association of Geological Societies.*

T37. The Western Interior Seaway (Posters). Cosponsored by *Paleontological Society; GSA Sedimentary Geology Div.; Gulf Coast Association of Geological Societies.*

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

T40. After the Last Ammonite and before the First Horse: Patterns of Ecological and Climatic Change during the Paleocene. Cosponsored by *Paleontological Society; Denver Museum of Nature & Science.*

T41. Recoveries from Mass Extinction: Patterns, Processes, and Comparisons. Cosponsored by *Paleontological Society; Gulf Coast Association of Geological Societies.*

T42. Breaking the Curve: Historical Development, Current State, and Future Prospects for Understanding Local and Regional Processes Governing Global Diversity. Cosponsored by *Paleontological Society; Gulf Coast Association of Geological Societies.*

T43. 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. Deep Time Earth Life Observatories (DETELOs): Focusing on Critical Transitions in the History of Life. Cosponsored by *Paleontological Society; Gulf Coast Association of Geological Societies.*

T45. Living Soil in Deep Time. Cosponsored by *Gulf Coast Association of Geological Societies.*

T46. Leaving Traces—Making Marks: In Honor of H. Allen Curran. Cosponsored by *Paleontological Society; Gulf Coast Association of Geological Societies.*

T47. Sclerochronological Archives from Rivers to the Sea: Documentation, Interpretation, and Utility. Cosponsored by *Paleontological Society.*

T48. Exploring the Role of Endobenthic Organisms in Enhancing Porosity and Permeability of Sedimentary Aquifers and Reservoirs. Cosponsored by *Paleontological Society; National Ground Water Association; GSA Sedimentary Geology Div.; Gulf Coast Association of Geological Societies.*

T49. What Good Are (Fossil) Plants Anyway? New Methods for Investigating Old Problems. Cosponsored by *Paleontological Society; Gulf Coast Association of Geological Societies.*

T50. Quantifying the Early Evolution of Life: Numerical Approaches to the Evaluation of Precambrian-Cambrian Animals and Ecosystems. Cosponsored by *Paleontological Society; Gulf Coast Association of Geological Societies.*

T51. Neontological Solutions to Paleontological Problems: Actualistic Studies of the Morphology, Behavior, and Ecology of Modern Analogs for Ancient Organisms. Cosponsored by *Paleontological Society; Gulf Coast Association of Geological Societies.*

T52. Paleontological and Sedimentological Consequences of Calcite and Aragonite Sea Dynamics. Cosponsored by *Paleontological Society; Gulf Coast Association of Geological Societies.*

T53. The Sedimentation of Organic Particles: Practical Applications. Cosponsored by *GSA Sedimentary Geology Div.; American Association of Stratigraphic Palynologists Inc. (AASP); Society for Sedimentary Geology (SEPM); GSA Coal Geology Div.; Gulf Coast Association of Geological Societies.*

T54. Integrative Systematic Paleontology for a New Century: Advancing Evolutionary, Phylogenetic, Biogeographic, and Ecologic Theory with Specimen-Based Studies. Cosponsored by *Paleontological Society.*

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

T56. Spatial and Temporal Evolution of Transform Faults. Cosponsored by *GSA Structural Geology and Tectonics Div.; Gulf Coast Association of Geological Societies.*

T57. Evolution of the Lithosphere and Upper Mantle in the Western United States. Cosponsored by *GSA Geophysics Div.*

T58. Geophysics in the Shallow Subsurface: Contributions to Studies in Agriculture, Water Resources, Geotechnical Engineering, and Surficial Geology. Cosponsored by *GSA Geophysics Div.; Environmental and Engineering Geophysical Society.*

T59. EarthScope: Bringing Geology and Geophysics Together to Study the 4-D Evolution of the Lithosphere. Cosponsored by *GSA Geophysics Div.; GSA Structural Geology and Tectonics Div.; GSA Geoinformatics Div.; Gulf Coast Association of Geological Societies.*

T60. Combining Geophysics and Geology: The George P. Woollard Award Session. Cosponsored by *GSA Geophysics Div.*

T61. Aspects of the Tectonic Setting and Structural History of Shale Basins that Lead to Unconventional Reservoir Rock. Cosponsored by *GSA Structural Geology and Tectonics Div.; Gulf Coast Association of Geological Societies.*

T62. Recent Advances in the Study of the Laramide Orogeny and Related Processes in Mexico and the Southern United States. Cosponsored by *GSA Structural Geology and Tectonics Div.; GSA Geophysics Div.*

T63. Foreland Basins: Their Tectonic Setting, Structural Geology, Sedimentology, and Economic Significance. Cosponsored by *GSA Structural Geology and Tectonics Div.*

T64. Lithospheric Structure and Geologic Evolution of the Gulf of Mexico Passive Margin. Cosponsored by *GSA Geophysics Div.; GSA South-Central Section; GSA Structural Geology and Tectonics Div.; Gulf Coast Association of Geological Societies.*

T65. Late Jurassic to Recent Geodynamic Evolution of the Caribbean Region. Cosponsored by *GSA Geophysics Div.; Gulf Coast Association of Geological Societies.*

T66. Caribbean–North America Plate Boundary Region: Arc Evolution, Timing of Collisions and Exhumation, Strike-Slip Tectonics and Paleogeography. Cosponsored by *GSA Structural Geology and Tectonics Div.; GSA International Div.*

T67. Geologic Maps, Digital Geologic Maps, and Derivatives from Geologic Maps (Posters). Cosponsored by *GSA Structural Geology and Tectonics Div.; 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.

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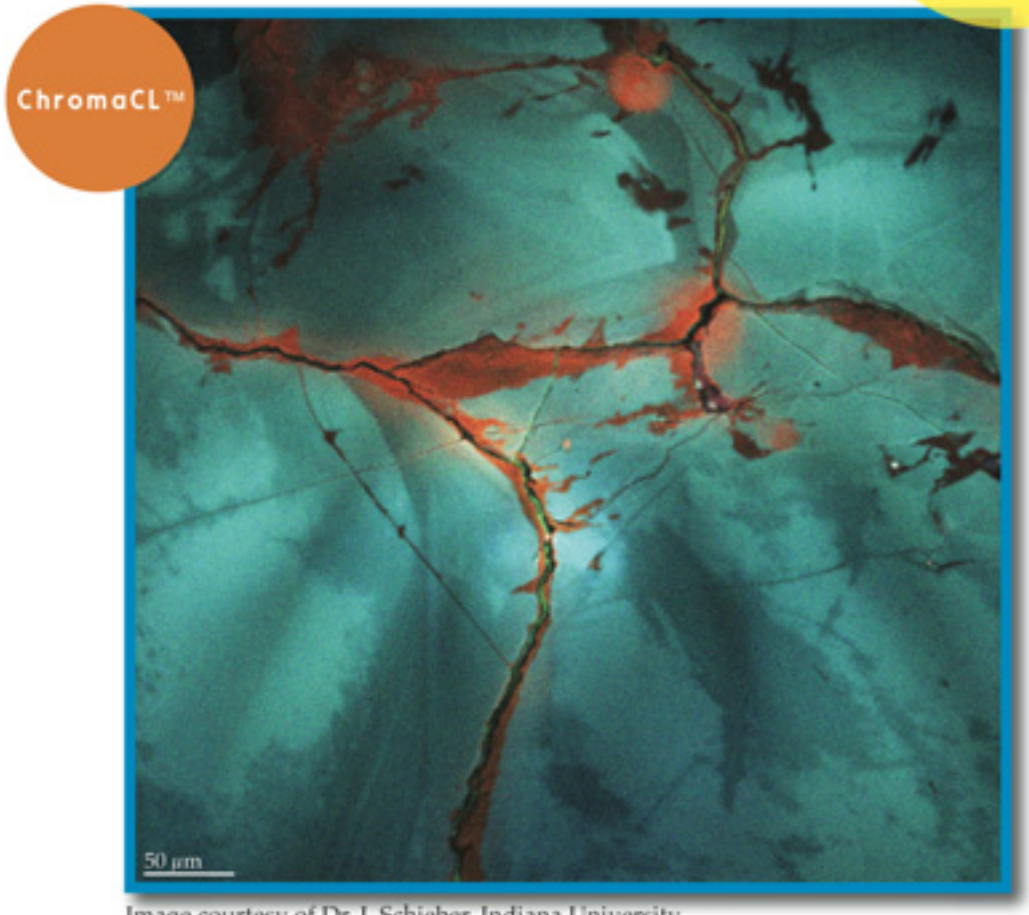

Image courtesy of Dr. J. Schieber, Indiana University.

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T68. Brittle Deformation and Diagenesis as Coupled Processes. Cosponsored by *GSA Structural Geology and Tectonics Div.; GSA Geophysics Div.; GSA Sedimentary Geology Div.; Gulf Coast Association of Geological Societies.*

T69. Constraints on Fault Evolution from Geologic, Geomorphic, and Geophysical Records. Cosponsored by *GSA Structural Geology and Tectonics Div.; Gulf Coast Association of Geological Societies.*

T70. Structural Modeling—Impacts on Hydrocarbon Recovery and Uncertainty Analysis. Cosponsored by *GSA Structural Geology and Tectonics Div.; Gulf Coast Association of Geological Societies.*

T71. Extensional Tectonics in the Central Basin and Range Province: Interplay between Science and Society in Assessments of Strain Rates, Seismic Hazards, Groundwater Reserves, and Mineral Resources. Cosponsored by *Gulf Coast Association of Geological Societies.*

T72. Scaling, Spatial Arrangement, and Fractals in Structural Geology. Cosponsored by *GSA Structural Geology and Tectonics Div.*

T73. Advances in Discontinuum Numerical Modeling in the Study of Earth Structure and Deformation. Cosponsored by *GSA Structural Geology and Tectonics Div.*

T74. Mathematical Models of Folding: Recent Advances, Applications, and Future Directions. Cosponsored by *GSA Structural Geology and Tectonics Div.; GSA Geophysics Div.*

T75. Modes of Lithospheric Extension: Oceanic and Continental Core Complexes. Cosponsored by *GSA Structural Geology and Tectonics Div.; GSA Geophysics Div.; GSA International Div.*

T76. Gondwana-Laurentia Terrane Transfers During the Pangean and Rodinian Supercontinent Cycles. Cosponsored by *GSA Geophysics Div.; Gulf Coast Association of Geological Societies.*

T77. Recent Advances in the Understanding of Adirondack and Southern Grenville Province Tectonics: In Honor of James McLelland. Cosponsored by *GSA Structural Geology and Tectonics Div.; Gulf Coast Association of Geological Societies.*

T78. From the Forearc to the Foreland: Contrasting Tectonics, Paleogeography, and Paleoenvironments of the North American Cretaceous. Cosponsored by *GSA Geophysics Div.; GSA Structural Geology and Tectonics Div.; GSA Sedimentary Geology Div.; Society for Sedimentary Geology (SEPM); Gulf Coast Association of Geological Societies.*

T79. The Himalayan Orogen and Rise of the Tibetan Plateau: An Earth Systems Approach to the Tectonic and Landscape Evolution of Asia. Cosponsored by *GSA International Div.; GSA Quaternary Geology and Geomorphology Div.; GSA Sedimentary Geology Div.; GSA Structural Geology and Tectonics Div.; GSA History of Geology Div.; GSA Geophysics Div.; Gulf Coast Association of Geological Societies.*

T80. Antarctic Science in the International Polar Year—Geologic Evolution of the Antarctic Peninsula: Changes in Tectonics, Biota, and Climate over Time. Cosponsored by *Gulf Coast Association of Geological Societies.*

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.*

T83. Mid- to Lower Crustal Deformation Processes: Strain, Kinematics and Relationships to Upper Crustal Structures. Cosponsored by *GSA Structural Geology and Tectonics Div.; GSA Geophysics Div.; Gulf Coast Association of Geological Societies.*

T84. Exhumation of Continental Ultrahigh-Pressure Terranes. Cosponsored by *GSA Structural Geology and Tectonics Div.; UNESCO International Lithosphere Program Task Force IV: Ultra-Deep Continental Crust Subduction; Gulf Coast Association of Geological Societies.*

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

T86. Reconciling Geologic and Geodetic Rates of Deformation. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; GSA Geophysics Div.; GSA Structural Geology and Tectonics Div.; Gulf Coast Association of Geological Societies.*

T87. Magnetism of Sedimentary Rocks and Sediments. Cosponsored by *GSA Geophysics Div.; GSA Sedimentology Div.; GSA Limnogeology Div.; GSA Structural Geology and Tectonics Div.; 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.*

T91. Strengthening Links between Metamorphic Conditions and Time: New Advances in High-Temperature Geochronology and Tracing *P-T-t* Paths of Metamorphic Terranes. Cosponsored by *Mineralogical Society of America.*

T92. Discovering Petrologic Truth in Minerals: In Honor of Bernard W. Evans. Cosponsored by *Mineralogical Society of America.*

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

T94. Nano-Phases and Nano-Structures in Earth Environments. Cosponsored by *Mineralogical Society of America; GSA Geobiology and Geomicrobiology Div.; Gulf Coast Association of Geological Societies.*

T95. Mineralogic and Petrologic Mapping of Planetary Surfaces: The G.K. Gilbert Award Session. Cosponsored by *GSA Planetary Geology Div.*

T96. Planetary Pummeling: Cataclysmic Bombardment of the Solar System as Catastrophe, Catalyst, Cauldron, and Crucible. Cosponsored by *GSA Planetary Geology Div.*

T97. Terrestrial Impact Structures: Origin, Structure, and Evolution. Cosponsored by *GSA Planetary Geology Div.; International Continental Scientific Drilling Program (ICDP); GSA Sedimentary Geology Div.; GSA Structural Geology and Tectonics Div.; GSA Geophysics Div.; Gulf Coast Association of Geological Societies.*

T98. Terrestrial Impact Craters as Windows into Planetary Crusts. Cosponsored by *GSA Planetary Geology Div.; Gulf Coast Association of Geological Societies.*

T99. The Geology of Small Volcanic Vents and Their Associated Vent Fields throughout the Solar System. Cosponsored by *GSA Planetary Geology Div.*

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.*

T101. Geological and Geophysical Remote Sensing Applications for Earth, the Moon, and Mars. Cosponsored by *GSA Structural Geology and Tectonics Div.; GSA Geophysics Div.; GSA Planetary Geology Div.; GSA Engineering Geology Div.; Gulf Coast Association of Geological Societies.*

T102. Water-Rock Interaction on Mars: Spacecraft Data, Meteorites, Models, and Analogs. Cosponsored by *Mineralogical Society of America; Lunar and Planetary Institute.*

T103. Glacial and Periglacial Processes and Landforms on Mars. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; GSA Planetary Geology Div.; 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).*

T105. Preparations for the New Era of Lunar Science: Laboratory Measurements and New Insights into the Moon. Cosponsored by *GSA Planetary Geology Div.; Gulf Coast Association of Geological Societies.*

T106. Current Research Issues in Lunar Stratigraphy. Cosponsored by *GSA Planetary Geology Div.; AAPG Astrogeology Committee.*

T107. Engineering Geology of the Lunar Regolith. Cosponsored by *GSA Planetary Geology Div.; Gulf Coast Association of Geological Societies.*

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

T109. Titan Geology: A New Frontier. Cosponsored by *GSA Planetary Geology Div.; Gulf Coast Association of Geological Societies.*

T110. Analog Sites and Field Exercises for Training Planetary Field Geologists. Cosponsored by *GSA Planetary Geology Div.; GSA Geoscience Education Div.; Gulf Coast Association of Geological Societies.*

T111. Modeling and Simulation of Dangerous Phenomena, and Innovative Techniques for Hazard Evaluation, Mapping, and Mitigation. Cosponsored by *Gulf Coast Association of Geological Societies.*

Lithosphere

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.

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/%7Ejpevans/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/)

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.

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T112. Landslide Inventories, Landslide Hazards, Databases, and Mapping: Status of Information and Progress toward a Shared Standard (Posters). Cosponsored by *GSA Engineering Geology Div.; GSA Quaternary Geology and Geomorphology Div.; GSA Geology and Society Div.; Association of American State Geologists; Gulf Coast Association of Geological Societies.*

T113. Natural Hazards Assessment, Evaluation, and Mitigation Using HAZUS-MH. Cosponsored by *GSA Engineering Geology Div.; GSA Geology and Society Div.; Gulf Coast Association of Geological Societies.*

T114. Advances in GIS-Based Runoff and Erosion Modeling in Low-Gradient Environments: Case Studies and New Methods. Cosponsored by *GSA Engineering Geology Div.*

T115. Geovisualization and GIS Techniques Applied in Engineering Geology. Cosponsored by *GSA Engineering Geology Div.; Gulf Coast Association of Geological Societies.*

T116. Shales, Claystones, and Mudstones: Characterization Methods and Engineering Problems. Cosponsored by *GSA Engineering Geology Div.; Gulf Coast Association of Geological Societies.*

T117. Problem Geologic Units in Slope Stability. Cosponsored by *GSA Engineering Geology Div.; GSA Geology and Society Div.; Gulf Coast Association of Geological Societies.*

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T188. Challenges and Experiences of Teaching Geosciences: Perspectives from New Instructors and Teaching Assistants. Cosponsored by *Gulf Coast Association of Geological Societies.*

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T200. Development of Web-Optimized Geologic Map Data Layers for North America. Cosponsored by *Association of American State Geologists, U.S. Geological Survey.*

T201. Geoantiquities and Unique Geological Heritage. Cosponsored by *GSA Quaternary Geology and Geomorphology Div.; GSA Geology and Society Div.; GSA Geoscience Education Div.; GSA Geoinformatics Div.; Gulf Coast Association of Geological Societies.*

T202. Propagating Geoinformatics and Virtual Globe Resources into the K–12 Environment: Integrating Spatial Earth System Data with Classroom Science for a Future Workforce. Cosponsored by *GSA Geoscience Education Div.; GSA Geoinformatics Div.; GSA Geology and Society Div.; National Association of Geoscience Teachers.*

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.*

T205. Health and Ecosystem Effects from Dry(ing) Lakes. Cosponsored by *GSA Geology and Health Div.; GSA Hydrogeology Div.; Gulf Coast Association of Geological Societies; GSA Limnogeology Div.*

T206. Geoscience Diversity 2008: Status, Strategies, and Successful Models. Cosponsored by *GSA Geology and Society Div.; GSA Geology and Public Policy Committee; GSA Geoscience Education Div.; Gulf Coast Association of Geological Societies.*

T207. Alpine Concepts in Geology and the Evolution of Geological Thought. Cosponsored by *GSA History of Geology Div.; GSA Structural Geology and Tectonics Div.; GSA International Div.; GSA Geophysics Div.; National Association of Geoscience Teachers.*

T208. History of the Influence of Religion on Geology and Geology on Religion. Cosponsored by *GSA History of Geology Div.; GSA Geology and Society Div.*

T209. Forensic Geology.

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PENROSE CONFERENCE SCHEDULED

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*
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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 GEOLOGICAL SOCIETY OF AMERICA®

33rd International Geological Congress, Oslo, Norway

Redefinition of the Quaternary and Pleistocene: Open Discussion

Open Meeting • 9 August 2008

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.

ROCK STARS Clarence Edward Dutton (1841–1912)

Geologist, Major of Ordnance, Man of Letters

Dutton as captain, Ordnance Corps. Courtesy U.S. Geological Survey, http://libraryphoto.cr.usgs.gov/.

William R. Halliday, *Hawaii Speleological Survey of the National Speleological Society, 6530 Cornwall Court, Nashville, Tennessee 37205, USA, wrhbna@bellsouth.net*

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 timelessness 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.

Only logic identifies these foreground figures as Dutton and his artist-assistant William Henry Holmes. Nevertheless, the scene eloquently portrays the enormity of Dutton's canyon country studies. James Lawrence Powell selected this scene for the dust jacket of his 2005 *Grand Canyon: Solving Earth's Grandest Puzzle*. Modern photograph of a sketch by W.H. Holmes; courtesy U.S. Geological Survey, http://libraryphoto.cr.usgs.gov/.

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.

"Rock Stars" is produced by the GSA History of Geology Division. Editorial Committee: Kennard Bork, Robert Dott, Robert Ginsburg, Peter von Bitter, and E.L. (Jerry) Winterer.

THE GEOLOGICAL SOCIETY OF AMERICA®

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.

Former GSA President Mary Lou Zoback is flanked by Representative Rush Holt (D–New Jersey) and Representative Judy Biggert (R–Illinois.), Co-Chairs of the Congressional R&D Caucus, at a press conference in the U.S. Capitol.

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.

THE GEOLOGICAL SOCIETY OF AMERICA®

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.**

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

DEADLINE: 15 JULY 2008

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.

GSA 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.


Photo by K.E. Asmus.

AN INVITATION TO PARTICIPATE

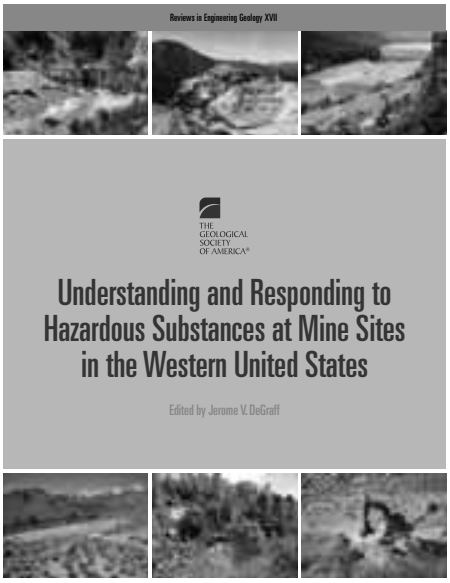
The Committee on Membership consists of six members-at-large, one of whom is a student, plus a GSA Councilor—all serving 3-year terms—along with a staff liaison. A committee chair is selected annually. This committee meets twice a year: once in-person (in March, with GSA covering travel costs when requested)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

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

Reviews in Engineering Geology available at the GSA Bookstore.



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

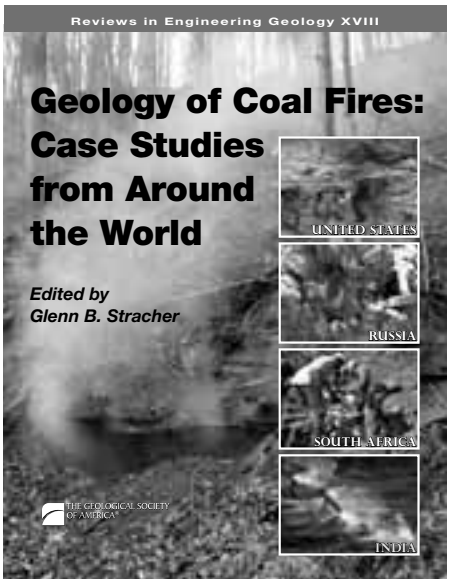
This volume documents interesting approaches, techniques and practical scientific considerations associated with mine site remediation. It also highlights how various federal, state, and local agencies and organizations are trying to bring the best science possible to bear on this serious problem. Some 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**

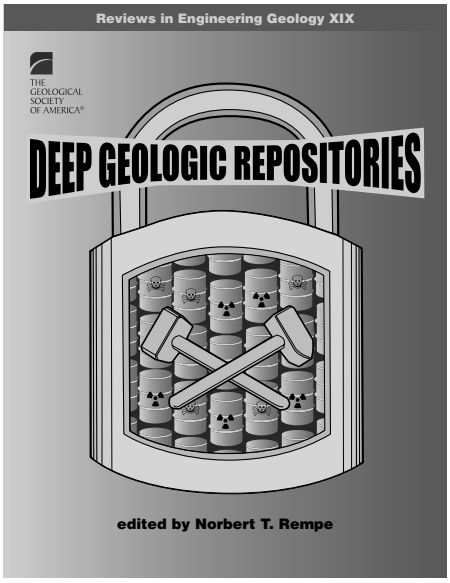
Member Price $42.00

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**

Member Price $56.00





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**

Member Price $35.00

www.geosociety.org/bookstore

Reviews in Engineering Geology

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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.

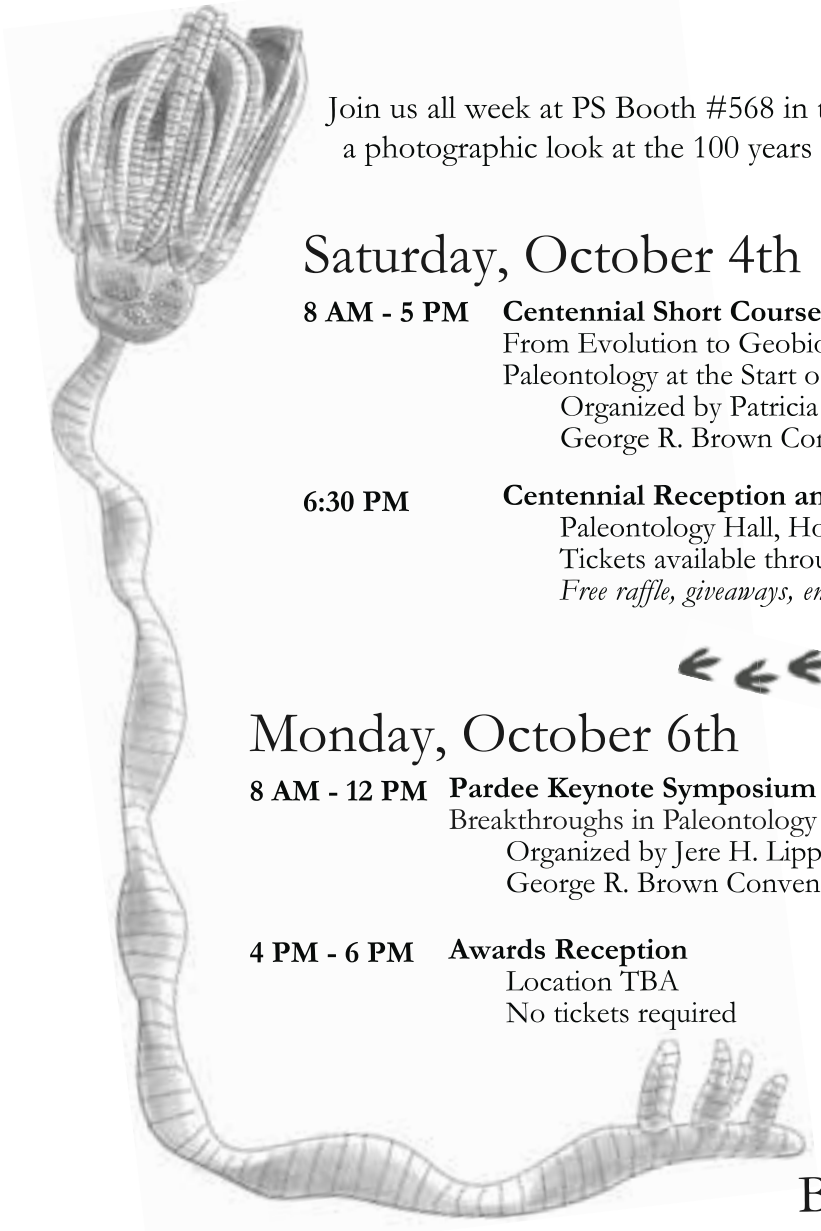
Our vision is to continue to provide the highest quality of educational opportunities to all GSA Members. If you want to share in this vision, please contact us, and we will be glad to forward your statement of interest to the Nominating Committee!

Edward C. Thornton, *Battelle Pacific Northwest National Laboratory, ecthornton@embarqmail.com*
Chair, 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

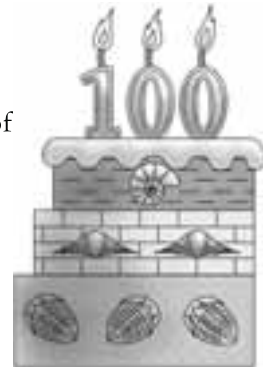
8 AM - 5 PM **Centennial Short Course**
From Evolution to Geobiology: Research Questions Driving Paleontology at the Start of a New Century
Organized by Patricia H. Kelley and Richard K. Bambach
George R. Brown Convention Center

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



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Building on a great record
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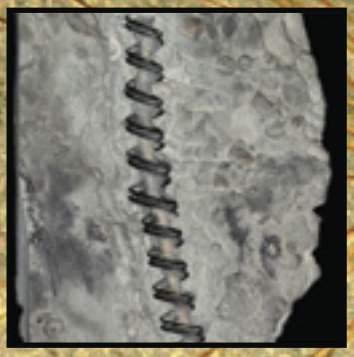
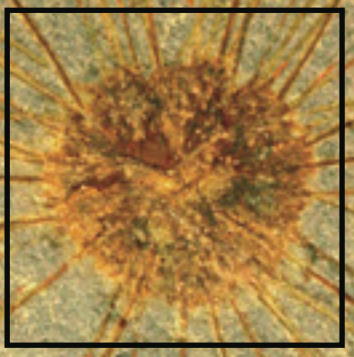
THE PALEONTOLOGICAL SOCIETY

Centennial
1908 - 2008


Celebrating 100 years of advancement of the science of paleontology


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@geosociety.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.

Classification	Per Line for 1st month	Per line each addt'l month (same ad)
Positions Open	$8.00	$7.75
Opportunities for Students		
First 25 lines	$0.00	$4.20
additional lines	$4.20	$4.20
Fellowship Opportunities	$8.00	$7.75
Situations Wanted	$3.60	$3.60

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 odurfjobs@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/EOE.

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

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, zarichny@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 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**

Journal Highlights

MAY/JUNE *GSA BULLETIN*

- Western China relaxes
- Ice on fire in Antarctica
- Franciscan exhumed in Mt. Diablo

JUNE *GEOSPHERE*

- Slick photorealistic modeling
- Dirty soil and water in the basin
- Revisiting old beds

JUNE *GEOLOGY*

- Carolina Keels Grounded
- A Truly Faithful Record of Climate Change?
- Savai'i Escapes the Plume Coffin

APRIL *ENVIRONMENTAL & ENGINEERING GEOSCIENCE*

- Beantown liquid ground
- California quakes and zoning
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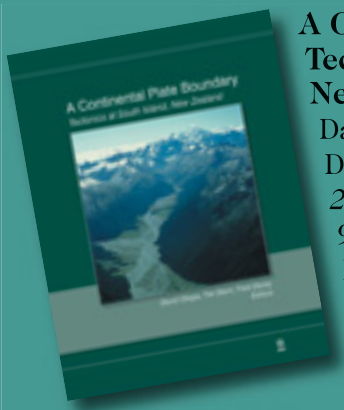

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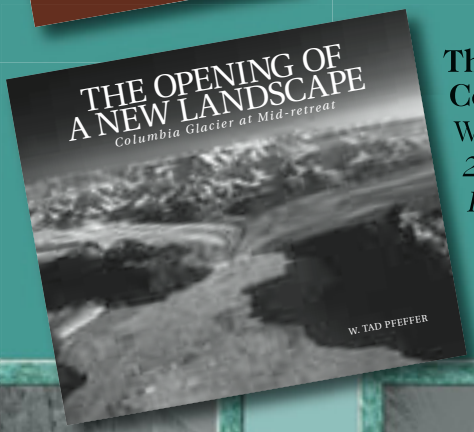

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