

GSA TODAY

VOL. 14, NO. 10

A PUBLICATION OF THE GEOLOGICAL SOCIETY OF AMERICA

OCTOBER 2004

Dilational fault slip and pit chain formation on Mars

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GSA TODAY (ISSN 1052-5173 USPS 0456-530) is published 11 times per year, monthly, with a combined April/May issue, by The Geological Society of America, Inc., with offices at 3300 Penrose Place, Boulder, Colorado. Mailing address: P.O. Box 9140, Boulder, CO 80301-9140, U.S.A. Periodicals postage paid at Boulder, Colorado, and at additional mailing offices. Postmaster: Send address changes to GSA Today, GSA Sales and Service, P.O. Box 9140, Boulder, CO 80301-9140.

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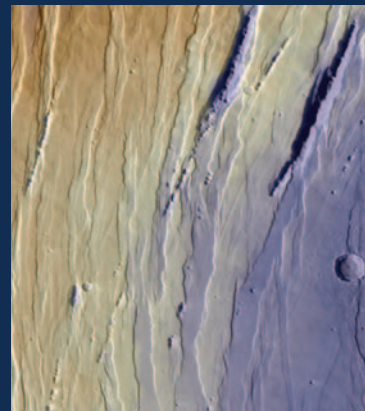
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Cover: The southeastern part of Alba Patera, a massive shield volcano in the western hemisphere of Mars, is cut by a dense network of normal faults, producing a horst and graben terrain. This normal fault system, along with many others on Mars, also hosts pit crater chains. In the image, these pit chains appear as north-northeast trending lines of depressions occurring within deep grabens (e.g., northeast corner) and associated with smaller-displacement normal faults. The image was created by draping a color coded digital elevation map (total relief in image is 4218 m; blue is low, brown is high) from Mars Orbiter Laser Altimetry (MOLA) data over a Viking photomosaic (illumination is from the west). See "Dilational fault slip and pit chain formation on Mars," by D.A. Ferrill et al., p. 4-12.



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Dilational fault slip and pit chain formation on Mars

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ABSTRACT

Pit crater chains that are parallel or collinear with normal faults are common on Mars, but only rarely observed on Earth. We explore the origin of pit crater chains using recent high-resolution imagery from Mars, laboratory simulation of pit chains, investigation of recent pit chains formed in response to seismic fault slip in Iceland, and assessment of rock failure criteria and the Martian crustal stress field to develop a deeper understanding of the relationship between pit chain formation and fault activity. Based on these analyses, we conclude that pit chains form in response to dilational fault slip. Because gravitational acceleration on Earth (9.81 m/s^2) is higher than on Mars (3.72 m/s^2), stress within Earth is greater than that of Mars for any given depth. Consequently, steep fault segments are likely to extend to about 5 km depth on Mars compared with about 2 km depth on Earth. Dilation of these steep segments associated with fault slip on Mars could result in large volume increase in the uppermost crust, influencing groundwater flow and discharge and mineralization. Based on crosscutting relationships, pristine pit morphologies, and lack of evidence of sediment accumulation in the bottoms of pits, we interpret that some pit craters may be actively forming in response to dilational fault slip.

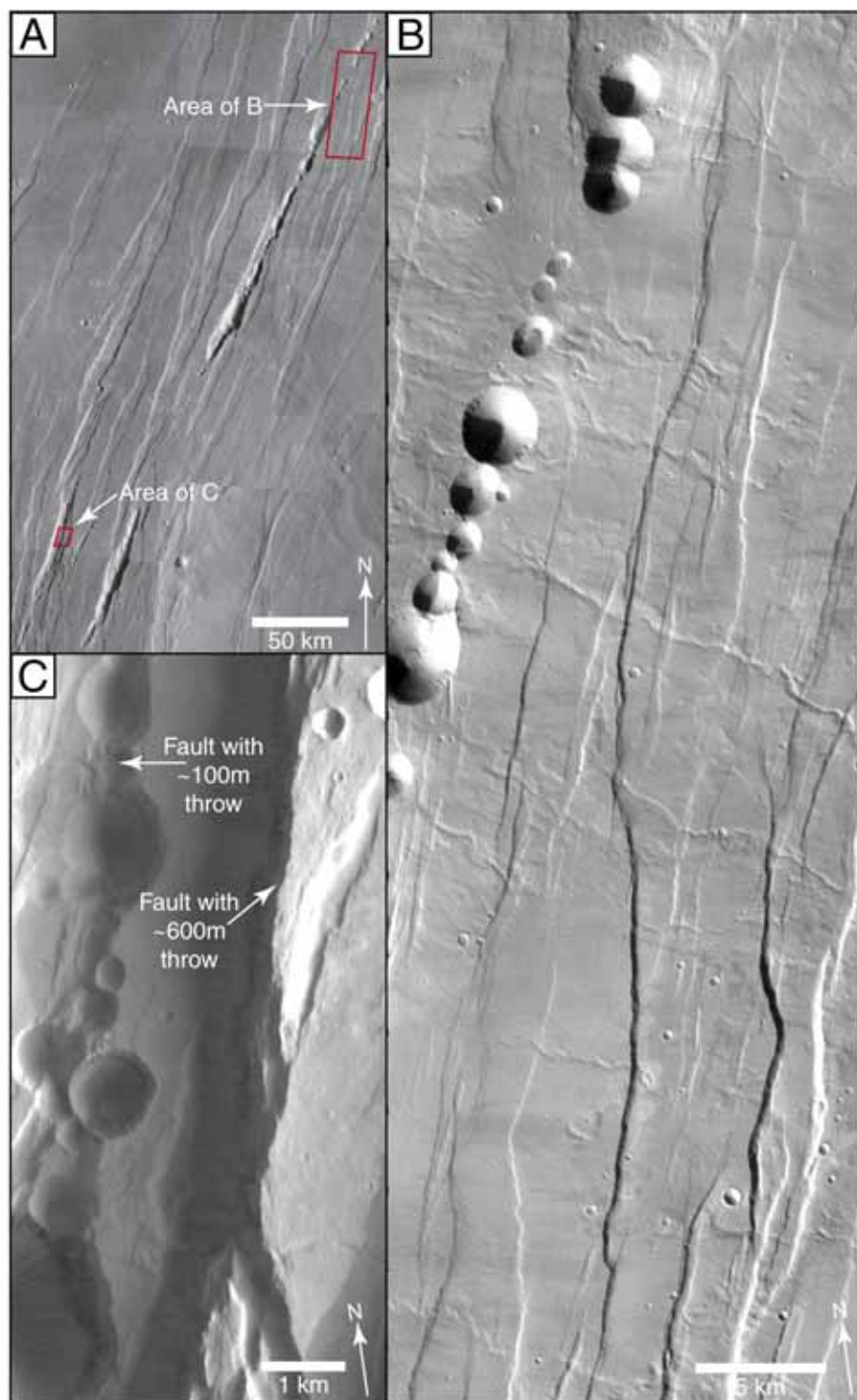


Figure 1. (A) Composite Viking imagery of normal fault scarps defining horsts and grabens in the southeast part of Alba Patera, Mars. Fault segmentation and en echelon arrangement of faults and grabens are common. Scale bar is 50 km. (B) THEMIS visible spectrum image shows detail of normal faults and pit chain (Phlegethon Catena) shown in A. Scale bar is 5 km. (C) Mars Orbital Camera image shows clear association of pit chains with normal fault scarps within graben on the southeast flank of Alba Patera. Scale bar is 1 km.

INTRODUCTION

The surface of Mars has been a source of debate since the earliest telescopic observations in the 1600s by Galileo, Huygens, and Cassini. Unprecedented detail in images and topographic maps generated by Mars missions within the past three decades allows identification of features carved by flowing water (Carr, 1996), accumulations of wind-blown sand and active dust devils (Malin and Edgett, 2001), and landforms generated by tectonic faulting (Schultz, 1985; Anderson et al., 2001; Wilkins and Schultz, 2003). Views of strata exposed in walls of canyons and pits demonstrate the presence of rock layers with different strengths (McEwen et al., 1999), dispelling the belief that the Martian surface has been so heavily damaged by impact cratering that it consists primarily of cohesionless regolith (Tanaka and Golombek, 1989).

Comparisons of geologic features on Mars with analogous features on Earth have been used extensively to understand Martian crustal processes. One distinctive feature of Martian topography is the occurrence of pit craters and pit chains (Tanaka and Golombek, 1989; Banerdt et al., 1992). Pit craters lack a raised crater rim or ejecta deposits, form alignments (chains), and are likely the result of collapse of loose surface material into a subsurface void (see Wyrick et al., 2004, and references therein). The close association of pit crater chains with faulting on Mars (Tanaka and Golombek, 1989; Wyrick et al., 2004) indicates that some Martian faults produce considerable subsurface void space. Collapse features seen on Earth are neither as widespread nor as large as those seen on Mars, nor is the mechanism of widespread dissolution of soluble rock, such as limestone or evaporites, observed on Earth likely on Mars. High-resolution imagery reveals that many pit craters have conical shapes. In addition, the walls of pit craters, troughs, grabens, and erosional canyons display a near-horizontal stratigraphy, composed of alternating layers with relatively low (gentle slopes) and relatively high (steep slopes) mechanical strength. The extreme size of pit craters on Mars, with diameters of individual pits reaching >4 km, and pit volumes >7 km³ (Wyrick et al., 2004), has remained an enigma.

Using recent high-resolution imagery from Mars, laboratory simulation of pit chains, investigation of recent pit chains formed in response to seismic fault slip in Iceland, and assessment of rock failure criteria and the Martian crustal stress field, we explore the origin of pit crater chains. We conclude that pit chains form in response to fault slip and dilation, consistent with the interpretation of active faulting on Mars (Anderson et al., 2001).

FAULT-LOCALIZED PIT CHAINS ON ALBA PATERA, MARS

Alba Patera is a large shield volcano, measuring 2700 km across, in the northern part of the Tharsis region on Mars (Cailleau et al., 2003). Normal faulting of Alba Patera is thought to have been active between the onset of the Noachian through the Early Amazonian—possibly more than a billion years of activity (Cailleau et al., 2003). Normal faults generally strike NNE-SSW through Alba Patera, but are tangential or locally circumferential to the volcano on the east, west, and northwest flanks of the volcano. Normal faults and associated horsts and grabens (fossae) locally host pit crater chains on

the eastern (Phlegethon Catenae, Archeron Catenae, Tractus Catenae) and western (Alba Catenae, Cyane Catenae, and Artynia Catenae) flanks of Alba Patera.

Images from Viking (e.g., Fig. 1A), Thermal Emission Imaging System (THEMIS; Fig. 1B), and Mars Orbital Camera (MOC; Fig. 1C) show the clear association of pit chains with normal faults, and the Phlegethon Catenae pit chain system displays the association of pits with a graben. Within a graben, pits and troughs tend to be localized along surface fault traces (Fig. 1C). The clear isolated pits in Fig. 1B are along a portion of Phlegethon Catenae where associated faults have relatively small displacements. Northeast and southwest of the area of Fig. 1B (see Fig. 1A) displacement increases laterally along the graben bounding faults and the pit chain has developed into a trough along the fault scarps. In the narrow-angle MOC image shown in Fig. 1C, pits are localized along a fault scarp with 100 m throw (based on Mars Orbiter Laser Altimeter, or MOLA, data). In the same figure, the fault with 600 m throw hosts a trough that we interpret to have developed from coalescence of a pit chain along the fault trace (Fig. 2A). The association of normal faults and pit chains (Fig. 2) implies that pit chains are surface indicators of normal faults which in turn influence

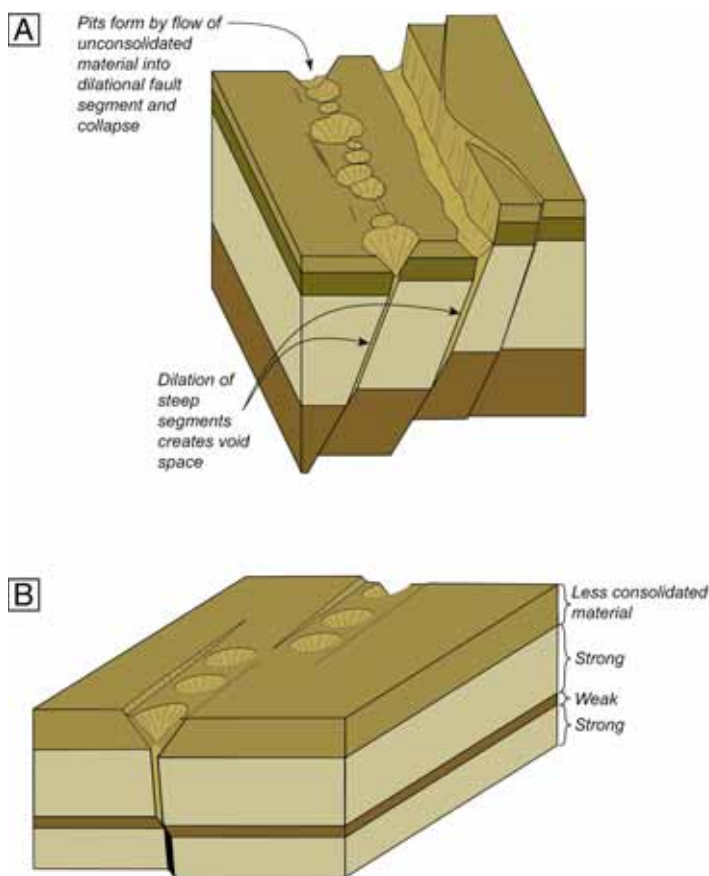


Figure 2. Schematic illustrations of faulting on Mars that display steep dilated faults and their potential relationship to pit chain development. (A) Pit chain and trough localized along the surface traces of dilational faults (compare with Fig. 1C). (B) Pit chain in surface graben in unconsolidated material above a dilational fault at depth (compare with Fig. 1A and B).

hydrothermal circulation, groundwater hydrology, and seismicity.

Using THEMIS visible spectrum image data for part of Phlegethon Catenae, we mapped pit crater outlines, surface drainage channels, and the footwall cutoff traces for all visible faults (Fig. 3A). East- and west-dipping faults are approximately evenly distributed, producing a system of horsts and grabens. Crosscutting relationships indicate that pit craters postdate fault scarps and drainage channels (e.g., Fig. 3A). Drainage channels radial to Alba Patera

are cut by faults with vertical offset and no consistent evidence of strike-slip displacement. In several cases, faults cut impact craters and there are no clear examples of impact craters postdating fault scarps. Pit craters can be observed at all stages of formation. One area where incipient pit crater formation can be observed is in Phlegethon Catenae (NW corner of Fig. 1B). Here, the smallest pits have apparently flat floors with surface textures similar to the surrounding topographic surface; the steeper pit walls are smooth. We interpret these as being

youthful pits where surface subsidence has not progressed so far as to have destroyed the original surface of in-falling material. This is supported by the location of these pits in relation to larger pits to the SW and NE. The overall geometry of this system suggests a breached relay structure between the propagating tips of the larger-displacement fault systems (e.g., Ferrill et al., 1999a).

Few if any impact craters are observed within pit craters (Fig. 1). Several large pits appear to have conical forms with no evidence of wall erosion or sediment accumulation. These observations suggest that the pit craters are among the youngest features on Mars. Eolian sediment transport continues to be active on Mars (Malin and Edgett, 2001); therefore, the lack of sediment accumulation and erosion in pit craters suggests that the pits have been active recently.

Although fault scarps appear to be steep, there is no reliable information to constrain the dip of the faults mapped. The consistent orientation of fault traces indicates that faulting took place in a uniform regional stress field. Slip-tendency analysis (Morris et al., 1996) of the Tractus Fossae fault system was performed applying a uniform normal-faulting effective stress tensor with an extension direction of 105° (σ_1 = vertical; σ_2 = azimuth 015°, 66% of σ_1 ; σ_3 = azimuth 105°, 32% of σ_1). This stress tensor orientation produces the highest slip tendency along mapped faults with dips of 65°–80°, would produce slip tendencies sufficient to overcome the frictional resistance to sliding on faults (Collettini and Sibson, 2001), and was the most probable orientation at the time of faulting (Figs. 3B and 3D). Dilation tendency analysis (Ferrill et al., 1999b) using the same stress tensor yields consistently high dilation tendencies for the same population of faults (Figs. 3C and 3E).

ANALOG MODELING

Based on our analysis of Mars data, we simulated slip on a normal fault with an upward steepening refracted cross-sectional profile beneath an undeformed and unconsolidated overburden. In these simulations, unconsolidated dry white or dyed sand represents Mars surficial materials (Sims et al., 2003). Constant thickness (1–3 cm) rigid wooden or aluminum plates, with or without an

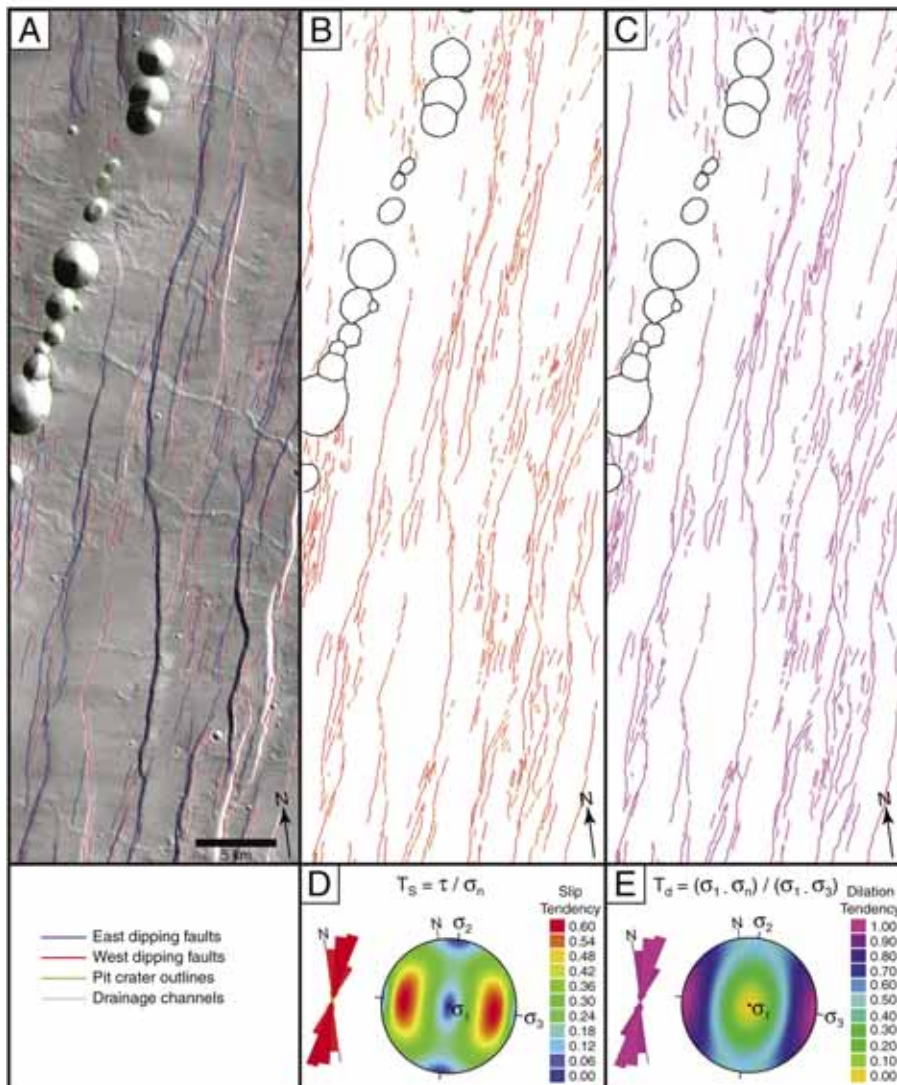


Figure 3. (A) Map of fault traces (footwall cutoff lines) in part of southeastern Alba Patera based on THEMIS visible spectrum image shown in Fig. 1. (B) Slip tendency (T_s) and (C) Dilation tendency (T_d) maps of Alba Patera faults, illustrate the strong preferred orientations of normal faults in the mapping area. τ = maximum resolved shear stress, σ_n = resolved normal stress, σ_1 = maximum principal compressive stress, σ_3 = minimum principal compressive stress. (D) and (E) contain lower hemisphere equal angle stereographic projection plots and length weighted rose diagrams for slip tendency analysis and dilation tendency analysis, respectively.

overlying layer of cohesive powder, were used to represent dilating fissures beneath the surficial material. Two fault geometries with imposed displacements were used to simulate fault geometry at depth: (a) a vertical upper fault segment linked to a horizontal detachment at depth (Sims et al., 2003), and (b) a vertical fault segment linked to a fault with

65° dip (consistent with slip tendency analysis) at depth (Fig. 4A). Plates were initially edge-to-edge, and tabular voids were created by progressively separating the plates. In some experiments, a layer of cohesive powder, capable of supporting steep to near vertical walls, was used in combination with rigid plates to represent the refracted fault geometries.

Fault traces were slightly irregular or corrugated (Ferrill et al., 1999a), similar to faults observed on Earth and Mars.

Most pit chain morphologies observed on Mars, including (i) chains of isolated circular or irregularly shaped pits, (ii) elongate pits, (iii) pit chains grading to troughs along trace, and (iv) pit chains along graben bounding faults (Wyrick et al., 2004), were reproduced in our physical models. Modeled pit chains follow a uniform developmental sequence from an alignment of circular pits of varying size, and variable (Sims et al., 2003) or regular (Horstman and Melosh, 1989) spacings, to elongate pits, to coalesced pits that form continuous troughs. Different stages of development were often present simultaneously along fault strike (e.g., Fig. 4H). Model pit chains tend to form somewhat irregular map traces, even where formed over parallel rigid plates. In some experiments, pit formation was preceded or accompanied by the formation of elongate grabens (Sims et al., 2003), with pit formation usually occurring along a single bounding fault.

In Model 19NOV03b (Fig. 4), displacement was gradually applied along the 65° fault segment at depth and produced oblique dilation of a vertical fault segment beneath a layer of cohesive powder. Overlying the cohesive powder was a layer of dry sand. As displacement progressed, an extension fracture propagated upward through the cohesive

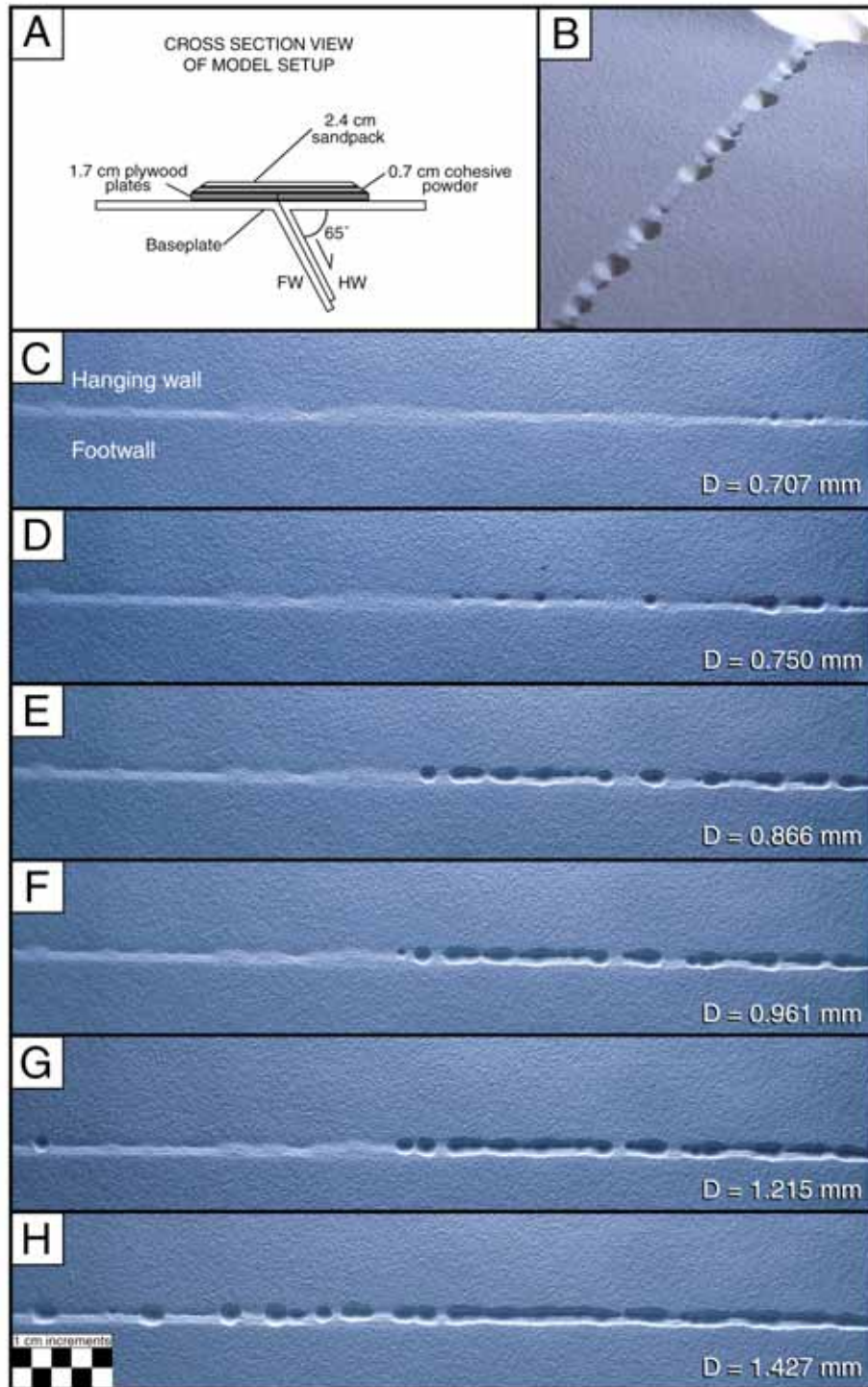


Figure 4. Analog modeling example of normal faulting and pit chain development. Model 19NOV03b produced a pit chain in unconsolidated sand above a refracted normal fault. (A) Schematic cross section illustrating model setup for simulation of pit chain development in a sandpack resting on a layer of relatively cohesive silica powder above a refracted normal fault that is vertical at the top and dips 65° at depth. Imposed displacement is normal dip slip along the 65° fault segment. The vertical fault segment experiences oblique dilation parallel to the slip vector on the 65° fault segment at depth. (B) Oblique photograph illustrating model pit chain development along the surface rupture trace of the normal fault. (C–H) Plan view photographs (illumination is from the top in each photo) of the model surface during progressive displacement, D, of the underlying normal fault.

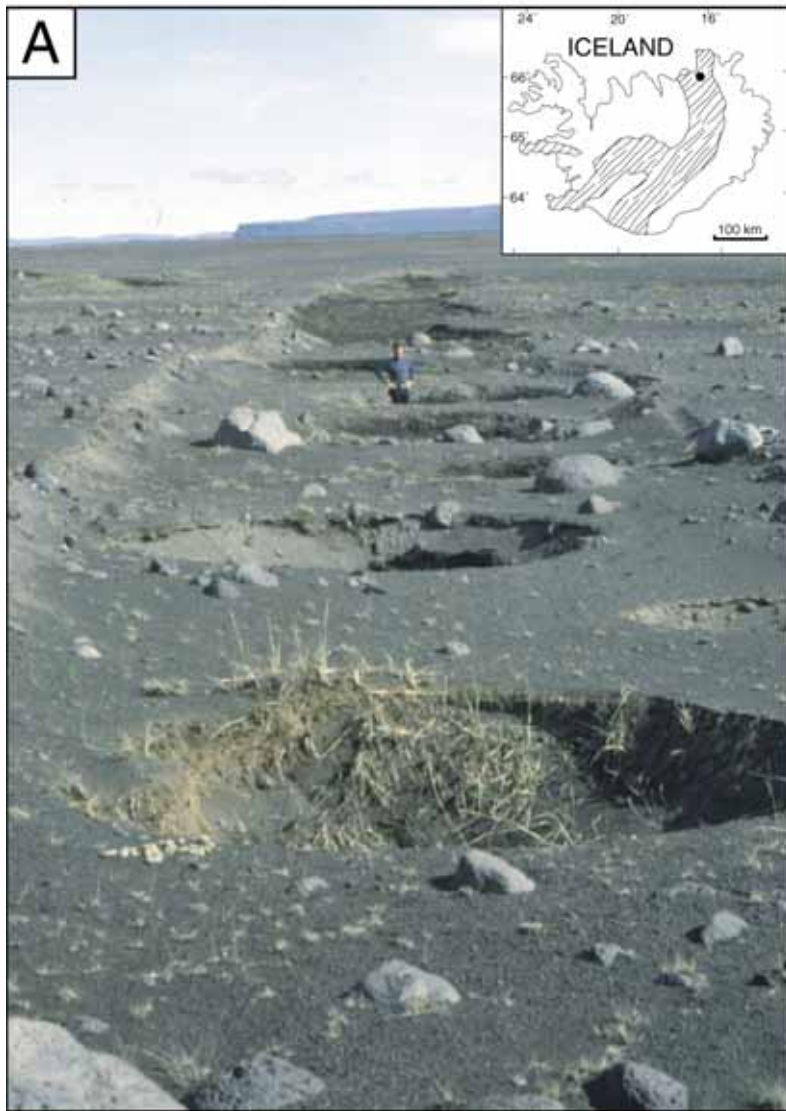


Figure 5 (here and on facing page). Pit chains in northeastern Iceland. (A) Shallow grabens and pit chain in gravels overlying basalt near the north coast of Iceland (inset map of Iceland shows the extent of the mid-Atlantic Ridge, and dot shows location of photograph near Ásbyrgi). Grabens and pit chains developed in response to an extensional deformation event in December 1975. Photograph was taken by George McGill on July 3, 1976. View is to the north. Note person (Bran Potter) standing in pit. (B) Aerial photograph taken on September 5, 1958, shows no evidence of pit chains and only subtle evidence of faulting. (C) Aerial photograph on September 2, 1976, shows pit chains. (D) Aerial photograph taken on August 3, 1984, shows growth and development of several pits between 1976 and 1984. Also during the 1976–1984 period, a stream channel established itself along one pit chain (trough), and subsequent erosion and deposition progressively erased the surface expression of the pit chain along the stream’s course.

powder layer and progressively dilated. The void space filled by draining of the overlying unconsolidated dry sand (Fig. 4), producing pits up to 1 cm diameter in the sand. Initially isolated pits gradually grew and intersected, forming elongate pits, scalloped sided coalesced pits, and relatively smooth-sided troughs (Figs. 4C–4H).

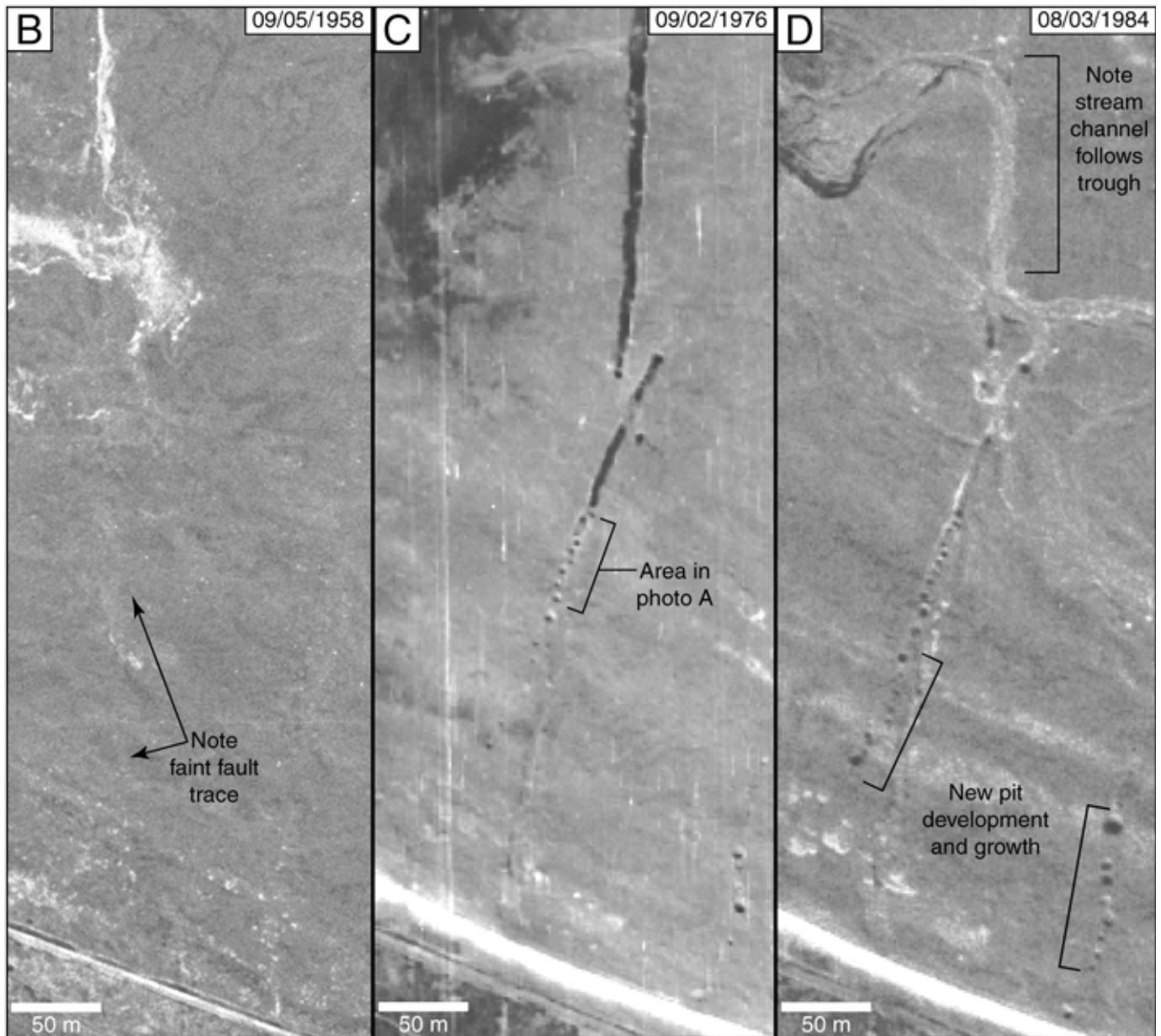
PIT CRATER CHAINS IN ICELAND

Although pit crater chains are common on Mars, comparable examples on Earth are rare (Wyrick et al., 2004). A striking example of pit chain development occurred in Iceland during the rifting episode that started in 1975. December 20, 1975, marked the beginning of a rifting and subsidence episode along the Mid-Atlantic spreading center

in northeastern Iceland. This first event, the largest event of the deformation episode, continued into February 1976 and was followed by 10 more events from September 1976 to May 1979 (Sigurdsson, 1980). Deformation events were marked by seismicity, small-volume volcanic eruptions at Krafla (during first, fifth, and sixth events), reactivation of faults along existing surface traces, grabens, and pit crater chains in alluvium where surface ruptures were previously unmapped. Seismicity and ground surface fissures associated with the December 1975 through February 1976 event were concentrated in a NNE-SSW-trending elongate region extending 30–50 km north of the Krafla caldera center. Surface ruptures with components of

dilation and normal dip slip (Opheim and Gudmundsson, 1989; Angelier et al., 1997; Dauteuil et al., 2001) formed along previously mapped fault traces in basalt flows. To the north, a 1–1.25-km wide and 12-km-long system of fault ruptures, fissures, and pit craters also formed in the floodplain deposits of Jökulsá á Fjöllum (Sigurdsson, 1980). In alluvium of the Jökulsá plain, within 2 km north of the contact with the gently northward-dipping basalt flows, the normal fault system reactivated by the first event produced a 1-km-wide graben that accommodated an estimated 1.5 m of horizontal extension and approximately 1 m vertical throw. The western graben-bounding fault system accommodated approximately 30 cm horizontal extension and 1 m vertical throw.

George McGill provided us with the ground photograph of a pit crater chain formed within this western graben-bounding fault system in the floodplain deposits of Jökulsá á Fjöllum during the December 1975 through February 1976 event (Fig. 5A). Aerial photographs taken on (1) September 5, 1958, (2) September 2, 1976, and (3) August 3, 1984, of the same region document the formation and evolution of this pit crater chain (Fig. 5). The photograph taken on September 5, 1958, (Fig. 5B) shows no evidence of pit chains and only subtle evidence of faulting. The aerial photograph taken on September 2, 1976,



(Fig. 5C) shows pit chains that trend NNE-SSW and consist of pits ranging in size from ~1 m to ~10 m in diameter. Some pit chains are clearly associated with normal faults, in some cases occurring within a down-dropped graben between two normal fault scarps. Aerial photographs taken on August 3, 1984, show growth of numerous pits between 1976 and 1984. Also during the 1976–1984 period, a stream channel established itself along one pit chain (trough), and subsequent erosion and deposition progressively erased the surface expression of the pit chain along the stream’s course. Aerial photographs taken after August 3, 1984, show some growth of

pits and minor change in the amount of erasure of pits by the stream erosion and deposition.

Although the pit crater chains formed during this crustal deformation episode in Iceland are small, generally <10 m diameter, they are excellent geologic analogs for pit craters observed on Mars. Faults along the Icelandic rift have dilational displacement (Opheim and Gudmundsson, 1989; Angelier et al., 1997; Dauteuil et al., 2001) and this is likely the result of the contrast in strength between basalt and interbedded ash and sediment (Ferrill and Morris, 2003). Where dilational jogs occur beneath unconsolidated surface material,

they cause subsidence of this material into fault-generated void space and hence pit crater formation. We interpret their small size to be due to the thin layer of unconsolidated surficial deposits overlying the basalt and a small void volume formed by 10 cm to 2 m fault displacements. In Iceland, pit crater volumes represent a short series of events and rapid sedimentation fills the pit crater before the next deformation event (Fig. 5D).

WHY ARE PIT CRATERS SO LARGE AND SO EVIDENT ON MARS?

On Mars, where erosion is minimal, pit size may represent a cumulative

volume as a result of many events spread out over time. On Earth, erosional and depositional processes may erase and/or subdue the surface expression of pit craters within decadal time scales. Although surface processes such as wind and meteorite impacts can erase pits, these processes are less effective than flowing water, which is the dominant erosive agent on Earth. Aerial photography from Iceland (Fig. 5) demonstrates the important role of erosion and deposition in the obliteration of terrestrial pit craters. Perhaps more important, the influence of Martian gravity on faulting in the brittle crust plays a major role in the overall geometry of Martian faults. Martian gravity at 3.72 m/s^2 is substantially less than Earth's gravity at 9.81 m/s^2 (Table I in Esposito et al., 1992) and this influence, along with rock density, controls the lithostatic stress profile, which is the primary influence on failure characteristics of rock at depth.

FAILURE MODES, NORMAL FAULT PROFILES, AND GRAVITY

Active normal faults on Earth commonly have steep dips near the surface and progressively more gentle dips at depth (Walsh and Watterson 1988). Dips of 70° – 90° are common in the uppermost brittle crust (0–2 km) in a variety of rocks including volcanic tuffs (Day et al., 1998), basalts (Opheim and Gudmundsson, 1989; Angelier et al., 1997; Dauteuil et al., 2001), limestones

(Ferrill and Morris, 2003; Ferrill et al., 2004), and clastic sedimentary rocks (Walsh and Watterson, 1988). Dips of 60° are common at depths of 2–5 km, and dips of 35° – 55° are common in the lower part of the brittle crust ($>5 \text{ km}$; Jackson and White, 1989; Collettini and Sibson, 2001). Dips of 0° – 35° are associated with detachments at the brittle-ductile transition in the crust and in extremely weak sedimentary layers.

Fault orientation in rock is initially controlled by mechanical properties of the faulted rocks, and magnitudes and orientations of the effective principal stresses at the time of failure. Failure angle is the angle between the failure plane and the maximum principal compressive stress at the time of failure. The angle of shear failure (θ) in rock can be calculated from the angle of internal friction (friction angle, ϕ) using:

$$\theta = \pm (45^\circ - \phi/2) \quad (1)$$

Failure mode depends on the differential stress ($\Delta\sigma = \sigma_1 - \sigma_3$; where $\sigma_1 =$ maximum principal compressive stress, and $\sigma_3 =$ minimum principal compressive stress) and the effective minimum principal compressive stress (σ_3' ; $\sigma_3' = \sigma_3 - P_f$, where $P_f =$ pore fluid pressure) at the time of failure, and upon the strength characteristics of the rock (e.g., Mandl, 1988 and references therein; Fig. 6A). There are three types of failure (Mandl, 1988; Ferrill and Morris, 2003). Shear

failure is characterized by a failure angle given by Equation (1), displacement parallel to the fracture surface, and the effective normal stress (σ_n') acting on the fracture surface, $\sigma_3' < \sigma_n' \geq 0$ (Fig. 6A). Tensile failure is characterized by a failure angle of 0° and displacement perpendicular to the fracture surface (Fig. 6A). In this case $\sigma_3' = \sigma_n' < 0$ and $|\sigma_3'| \geq$ tensile strength of the rock. Hybrid failure is characterized by a failure angle between 0° and the angle calculated by Equation (1), and displacement oblique to the fracture surface ("dilatant faults," Mandl, 1988; Fig. 6A). Hybrid fracture, hypothesized and debated for decades, has recently been demonstrated in laboratory experiments (Ramsey and Chester, 2004). In the case of hybrid failure, $\sigma_3' < \sigma_n' < 0$ and $|\sigma_3'| <$ tensile strength of the rock.

The normal faulting regime is defined by a vertical maximum principal compressive stress (Anderson, 1951). The vertical or lithostatic stress (σ_v) increases with depth and is a function of the thickness (h) of the overburden, the integrated density of the overburden (ρ), and the acceleration due to gravity (g):

$$\sigma_v = \rho gh \quad (2)$$

As a result of the vertical stress gradient, differential stress required for failure also increases with depth. Assuming a range of density values of 2.7 – 3.1 g/cm^3 for basalt (Carmichael, 1989) as examples,

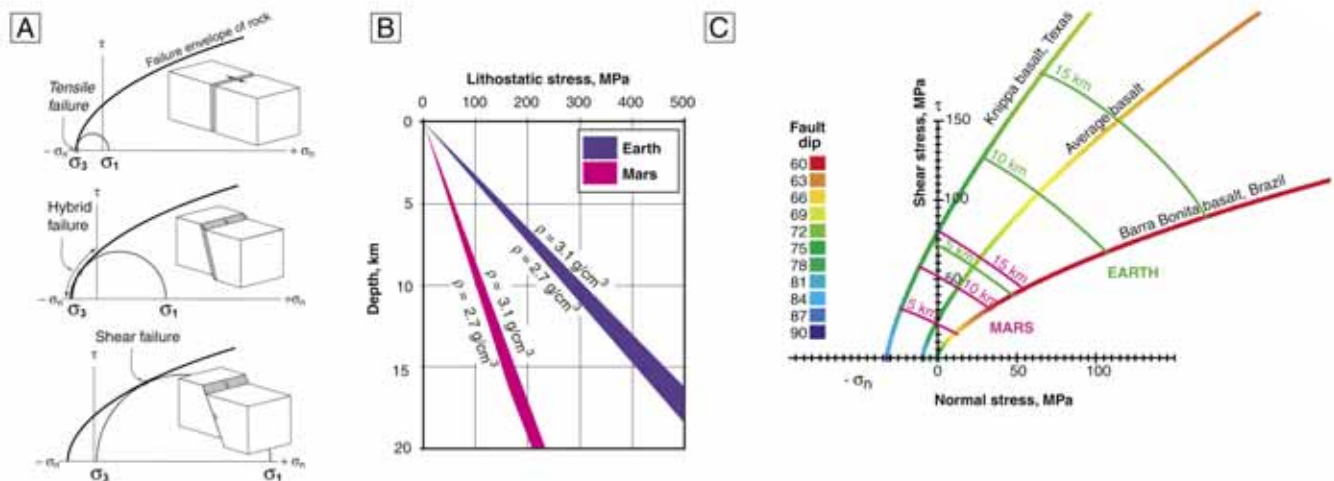


Figure 6. (A) Mohr circle and illustration of tensile, hybrid, shear failure modes (after Ferrill and Morris, 2003). (B) Lithostatic stress gradients on Earth vs. Mars assuming same rock type (basalts) and no hydrostatic gradient. (C) Hoek-Brown failure envelopes for basalt, color coded according to fault dips for the normal faulting regime, comparing depths of occurrence in Earth (green) versus Mars (red).

lithostatic stresses can be calculated as a function of depth for Earth ($g = 9.81 \text{ m/s}^2$), and Mars ($g = 3.72 \text{ m/s}^2$) (Fig. 6B). Hoek-Brown failure envelopes (Hoek and Brown, 1988; Schultz and Zuber, 1994) were constructed for an average basalt and two end-member basalts based on failure test data from 37 basalts (Gevantman, 1982). Basalt was chosen as a likely rock type on Mars because extensive volcanic plains cover half of its surface (Gornitz, 1997). Each point on a failure envelope represents a unique value for $\Delta\sigma$, and because the envelopes are nonlinear (especially at low values of $\Delta\sigma$), each point also represents a unique value of the failure angle. Because $\Delta\sigma$ for failure is depth-related, and ignoring the effects of pore fluid pressure, the envelope curves can be color-coded for normal fault dip (normal fault dip = $90^\circ - \text{failure angle}$) and correlated with depth in the crust for both Mars and Earth (Fig. 6C). Tensile and hybrid failure for an "average basalt" and corresponding fault dips of $78^\circ\text{--}90^\circ$, would be limited to $<2 \text{ km}$ on Earth, but are likely to depths of $\sim 5 \text{ km}$ on Mars.

Fault profiles on Mars are likely to be similar in shape to analogs on Earth, but depth-dependent fault dip transitions are likely to occur deeper than on Earth and occur more gradually with depth. The seismogenic depth associated with extensional deformation on Mars is expected to be shifted deeper due to lower gravity, but would also depend on geothermal gradient at the time of active faulting. Dilational faulting, found in the upper $\sim 2 \text{ km}$ on Earth, may extend to depths of 5 km or more on Mars due to the factor of 2.64 difference in gravity.

DISCUSSION

The common occurrence of pit crater chains on Mars compared with Earth is probably controlled by two factors: weathering and erosion rates and faulting style. Earth's surface is reworked much more rapidly than that of Mars because of the thicker terrestrial atmosphere and the prevalence of surface and near surface water. Pit crater chains formed in Iceland have been significantly modified and even obliterated within a decade of formation. Martian pit craters are larger by at least an order of magnitude than any on Earth. This size difference has three likely sources: (i)

thickness of low-cohesion surface material, (ii) depth-extent of the dilational fault segment generating the subsurface void, and (iii) Martian pit craters represent a cumulative volume over a number of faulting events, whereas on Earth, pit crater volume represents a single event. Normal faults and extension fractures on Mars are more likely to be dilatant and extend to greater depths than similar features on Earth because of the lower Martian gravity and consequent lower stress gradient.

Martian thermal history may also have influenced the prevalence of dilational faults. Mars has cooled and consequently the thickness of the Martian cryosphere and the thickness of ice in the cryosphere has increased over time (Clifford and Parker, 2001). At a latitude of $30\text{--}40^\circ\text{N}$ on Mars today (e.g., Alba Patera examples in Fig. 1), the top of ice is estimated to be at a depth of 10 m (Fanale et al., 1986) and extend to a depth of $3.5\text{--}5 \text{ km}$ (Clifford and Parker, 2001). The strength of unconsolidated material increases as freezing occurs (p. 272 in Sowers, 1979), therefore steepening the failure envelope. Consequently, the shear failure angle decreases and the stress range over which hybrid failure can occur increases, resulting in steeper dips for faults forming in a frozen stratigraphic section. Deeply frozen rock and unconsolidated materials (Carr, 1996; Clifford and Parker, 2001) would generate deeper, steeper dilatant fault segments. This effect on faulting would be more pronounced as the planet cooled.

Faults and fractures form important pathways for and barriers to groundwater flow on Earth (e.g., Ferrill et al., 2004, and references therein). We anticipate a similar relationship between these features and past groundwater flow on Mars. The occurrence of dilational faulting on Mars indicates highly permeable zones and potentially important sites for storage of water or ice and locations of mineralization. Pit chains indicate the presence (either now or formerly) of subsurface voids and potential conduits for groundwater flow, whether unfilled or filled with porous material. Understanding their mechanism(s) of formation is essential for constraining volumes and locations (depth and lateral extent) of groundwater flow conduits and potential areas of water storage,

with major implications for the subsurface distribution and movement of water and mineralization in the Martian crust. Recent description of outflow channels sourced by pits supports the interpretation of pit chains as indicators of important groundwater flow and discharge pathways (Dinwiddie et al., 2004). This interpretation is also consistent with outflow channels sourced by fractures (see summary in table IV of Clifford and Parker, 2001).

CONCLUSIONS

Many pit crater chains on Mars are produced by dilational normal faulting. Pit craters are larger and better preserved on Mars than on Earth because of more active erosion and deposition on Earth and the lower gravity and greater vertical extent of the zone of dilational faulting on Mars. In many areas, pit crater chains appear to be some of the youngest features, postdating drainage channels, faulting, and impact craters. Based on crosscutting relationships, pristine pit morphologies, and lack of evidence of sediment accumulation in pits, we believe that some pit craters may be actively forming. Dilational faults, whether partially filled or open cavities, are likely to have served as conduits for past groundwater flow and would now serve as reservoirs for water or ice.

ACKNOWLEDGMENTS

This work was funded by Southwest Research Institute through the Internal Research and Development Program (project #R9314). George McGill brought to our attention the occurrence of pit chains in Iceland and was gracious in allowing us to use his field photograph. Shannon Colton assisted with MOC and Viking data preparation, Clark Chapman provided consultation on ages of Martian landscapes, and Bob Grimm provided consultation on the Martian cryosphere and hydrology. Larry McKague and John Russell improved this paper by their constructive reviews. We appreciate the assistance of Cheryl Patton in preparation of the manuscript. Comments by reviewers Robert Anderson, James Dohm, Jay Melosh, Gerry Ross, Richard Schultz, and Glen Stockmal further improved the manuscript.

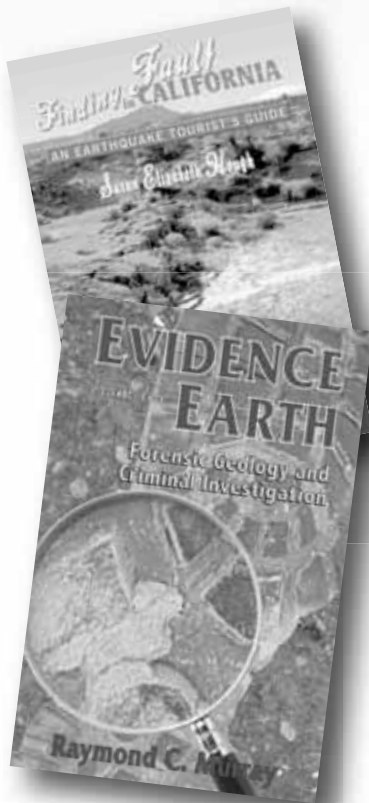
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*Manuscript received May 11, 2004;
accepted July 13, 2004.*

Nurturing Relations between the Applied and Academic Geoscience Communities

B. Clark Burchfiel, GSA Past President

In September 2002, GSA sent a Publications Research Survey to its members. Written responses to this survey indicated a number of our members are employed in "applied" geology, and they consistently expressed the opinion that GSA was not meeting their needs.

In looking into this more thoroughly, I discovered that more than 25% of our membership work in areas broadly covered by the term applied geoscience. Several members have relayed to me the point that all geology can be considered applied.

It was also frequently mentioned in these responses that GSA is perceived as mainly an academic society and that applied geoscience takes a back seat. Having worked as a consultant in industry for many years, I am aware of the significant contributions that can be made by cross fertilization of ideas and technology between applied and academic geoscience. It is an important two-way scientific street.

In order to clarify the concerns of our applied colleagues and to see how GSA could better serve them, I e-mailed all our applied scientific members requesting information on how GSA could be more responsive to their needs. I was pleasantly surprised by the large number of thoughtful responses I received. Many were 3–6 pages long with discussions and suggestions for how GSA could better integrate the two communities. Thanks to all members who took the time to write such thoughtful letters. I read them all!

It has taken some time to decide how to address the issue of better integration of the applied and academic communities within GSA. Such integration will be clearly advantageous to both groups.

One point made by many respondents was that GSA should not try to compete head on with other societies that more directly serve applied geoscientists and have well-established programs that meet their needs. For example, most respondents did not support the establishment of a new Division of Applied Geology because most of them already belong to one or more GSA Divisions, many of which already have an important applied component.

Respondents offered a wide range of suggestions, and it is clear that GSA cannot incorporate them all. It is also clear that GSA should not try to be all things to all geoscientists. Many respondents commented that GSA could play an important role filling niches not filled by other societies.

In order to find and fill such niches, I recommended to GSA Council that we establish a standing committee to develop more effective approaches to bring the applied and academic communities closer together. Council unanimously approved the committee, agreeing that this was an important direction for GSA to take.

The key to making a success of this new initiative is selecting a committee that will be proactive in canvassing our applied members, determining their needs, developing ideas on how GSA can better satisfy these needs, and serving as a focal point for better integrating the two communities. Scott Burns has enthusiastically agreed to head the committee, and he has put together an excellent group of geoscientists to begin this important work.

Communications between applied and academic scientists is one important first step, and both communities must take an active role. If you have ideas or want to be involved in some way, contact Scott at burnss@pdx.edu. I hope that many of you will try to make this initiative a success, as it will benefit all of us.

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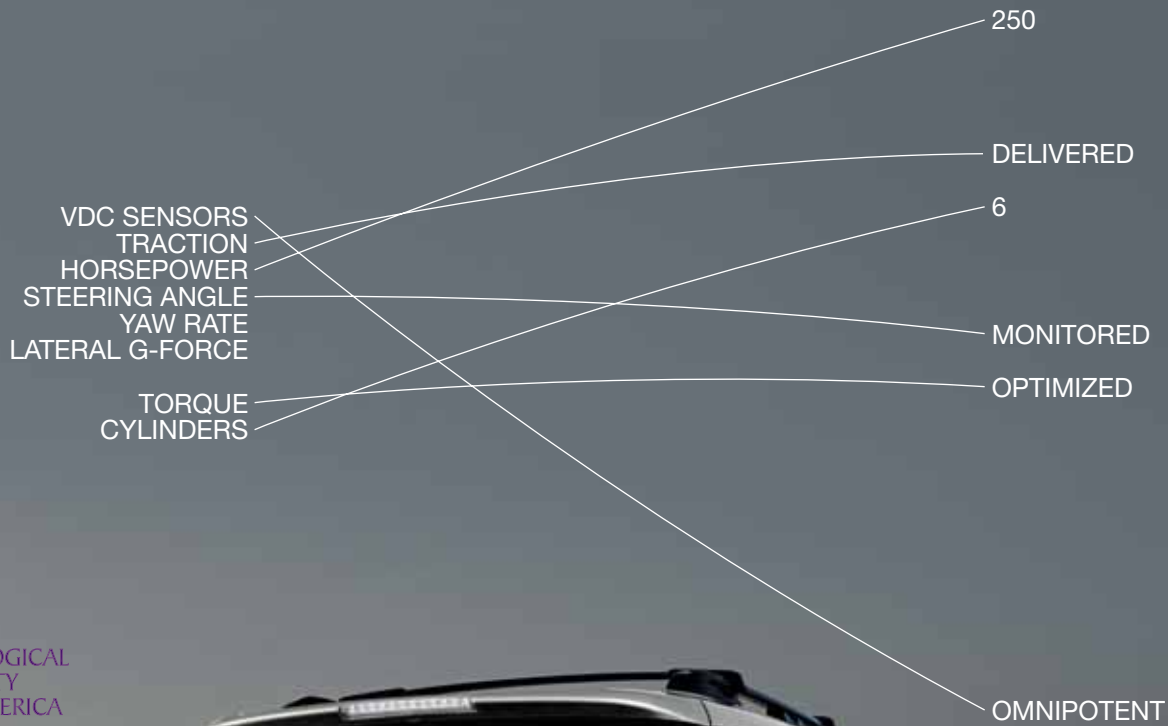
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—Jane Selverstone



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GSA Annual Meeting Program

Geoscience in a Changing World: Denver 2004

249 Technical Sessions

All sessions will be held at the Colorado Convention Center and are oral unless indicated as poster sessions. Check the GSA Web site—www.geosociety.org—for updates, detailed listings, abstracts, and the titles and authors database.

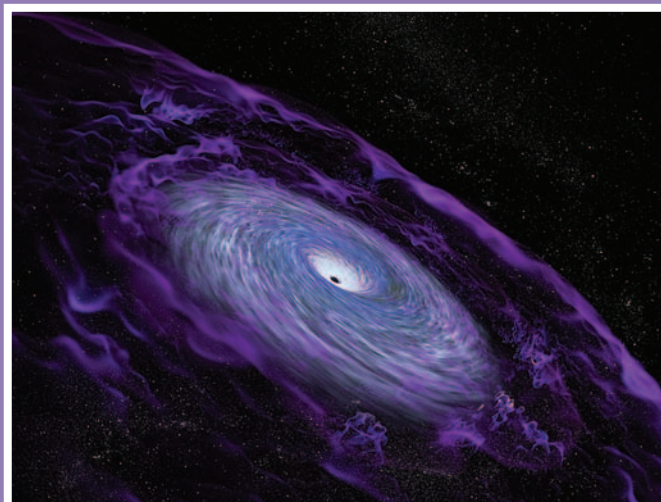
NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
SUNDAY, NOVEMBER 7, 2004			
1	8 a.m.	Geomorphology I	107/109
2	8 a.m.	Geoscience Education I	603
3	8 a.m.	Paleoclimatology/Paleoceanography I	708/710/712
4	8 a.m.	Paleontology I: Macroevolution from Genotype to Phenotype	702/704/706
5	8 a.m.	Planetary Geology	605
6	8 a.m.	Tectonics I: The Cordillera, from the Canada Basin to Southern Sierra Nevada and Basin and Range	104/106
7	8 a.m.	P4. Medical Geology (<i>GSA Engineering Geology Division</i>)	Ballroom 2 & 3
8	8 a.m.	T1. The Future of Hydrogeology I (<i>GSA Hydrogeology Division; International Association of Hydrogeologists/U.S. National Committee; National Ground Water Association</i>)	Ballroom 4
9	8 a.m.	T23. Sources, Transport, Fate, and Toxicology of Trace Elements in the Environment (<i>GSA Geobiology and Geomicrobiology Division; International Association of Geochemistry and Cosmochemistry</i>)	207
10	8 a.m.	T27. Characterization and Representation of Flow through Karst Aquifers I (<i>GSA Hydrogeology Division</i>)	205
11	8 a.m.	T33. Geologic Disposal of Radioactive Waste: Rising to the Challenge of Regulatory Requirements and Environmental Protection at the Waste Isolation Pilot Plant (WIPP) Near Carlsbad, New Mexico, and the Yucca Mountain Site, Southern Nevada I (<i>GSA Hydrogeology Division; U.S. Department of Energy; GSA Geology and Public Policy Committee</i>)	203
12	8 a.m.	T44. Lacustrine Records of Landscape Evolution (<i>GSA Limnogeology Division; GSA Quaternary Geology and Geomorphology Division; GSA Sedimentary Geology Division</i>)	709/711

NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
13	8 a.m.	T49. Stable Isotopes in Fossils and Paleosols: Records of Late Cenozoic Environmental Change (GSA Sedimentary Geology Division)	703
14	8 a.m.	T56. Paleontology and Stratigraphy of the Late Eocene Florissant Formation, Colorado (Paleontological Society; GSA Limnogeology Division; GSA Sedimentary Geology Division)	705/707
15	8 a.m.	T62. Wild Coal Fires: Burning Questions with Global Consequences? (GSA Coal Geology Division)	102
16	8 a.m.	T71. Granitic Pegmatites: Recent Advances in Mineralogy, Petrology, and Understanding I (Mineralogical Society of America)	607
17	8 a.m.	T75. A Xenolith Perspective on the Physical and Chemical Evolution of Continental Lithosphere (GSA Structural Geology and Tectonics Division; Mineralogical Society of America; GSA Geophysics Division)	108/110/112
18	8 a.m.	T88. Thrust Belts and Plateaus: The Anatomy of Convergent Systems (GSA Structural Geology and Tectonics Division; GSA Geophysics Division)	103/105
19	8 a.m.	T92. Neotectonics and Earthquake Potential of the Eastern Mediterranean Region (GSA Structural Geology and Tectonics Division; GSA Geophysics Division)	111/113
20	8 a.m.	T114. Geology in the National Parks: Research, Mapping, and Resource Management I (National Park Service)	201
21	8 a.m.	T135. Improving Delivery in Geoscience Education (IDIG): A Session Celebrating Dorothy LaLonde Stout (National Association of Geoscience Teachers; GSA Geoscience Education Division)	601
22	8 a.m.	Paleontology (Posters) I: Paleoecology	Exhibit Hall
23	8 a.m.	Quaternary Geology (Posters) I	Exhibit Hall
24	8 a.m.	Stratigraphy (Posters)	Exhibit Hall
25	8 a.m.	T119. Sigma Gamma Epsilon Student Research (Posters) (Sigma Gamma Epsilon)	Exhibit Hall
26	1:30 p.m.	Coal Geology: Emphasis on Active Coalbed Methane Plays—Session Dedicated to Charles L. Pillmore and His Work in the Raton Basin.	102
27	1:30 p.m.	Geochemistry I: Geochemistry of the Earth's Surface	601
28	1:30 p.m.	Geomicrobiology: Microbe-Mineral Interactions, Life in Extreme Environments, and Early Microbial Life on Earth	703
29	1:30 p.m.	Paleoclimatology/Paleoceanography II	708/710/712
30	1:30 p.m.	Paleontology II: Biogeography and the History of Life	705/707

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Colorado Convention Center, Room 606/608
Tues., Nov. 9, 12:30–6 p.m.



"Blackhole" by Leonard Wikberg III, who specializes in imaging and animation for science visualization (www.ScienceData.net). Art by Leonard will be shown at the Planetary and Space Art Exhibit Works during this year's Annual Meeting in Denver. This visually appealing event, sponsored by the Planetary Geology Division, will exhibit original creations by scientists and artists who specialize in heavenly and geology/nature works. On display will include paintings/drawings by Bill Hartmann, Dan Durda, Michael Carroll, Dirk Terrell, Jim Scotti, and Mary Chapman; Earth material abstracts by Ulrike Arnold; electronic video art by Leonard Wikberg III and Icelandic video art by Anna LÍndal; and photographic/imaging works by Malin Space Science Systems, Anne Cote, Steve Metzger, Dona Jalufka, and Michael Collier. The cost of the event is a very reasonable \$2.00/person. For more information, contact Mike Kelley (mkelley@georgiasouthern.edu) or Mary Chapman (mchapman@npgcable.com).

NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
31	1:30 p.m.	Paleontology III: Life and Climate	702/704/706
32	1:30 p.m.	Quaternary Geology I	103/105
33	1:30 p.m.	Stratigraphy I: General Stratigraphy	111/113
34	1:30 p.m.	P3. Geoscientific Aspects of Human and Ecosystem Vulnerability (<i>U.S. National Committee for Geosciences; GSA Critical Issues Caucus; GSA Geology and Public Policy Committee; GSA Geology and Society Division</i>)	Ballroom 2 & 3
35	1:30 p.m.	T1. The Future of Hydrogeology II (<i>GSA Hydrogeology Division; International Association of Hydrogeologists/U.S. National Committee; National Ground Water Association</i>)	Ballroom 4
36	1:30 p.m.	T5. Groundwater Depletion and Overexploitation in the Denver Basin Bedrock Aquifers (<i>GSA Hydrogeology Division; International Association of Hydrogeologists U.S. National Committee; GSA Geology and Public Policy Committee</i>)	207
37	1:30 p.m.	T27. Characterization and Representation of Flow through Karst Aquifers II (<i>GSA Hydrogeology Division</i>)	205
38	1:30 p.m.	T33. Geologic Disposal of Radioactive Waste: Rising to the Challenge of Regulatory Requirements and Environmental Protection at the Waste Isolation Pilot Plant (WIPP) Near Carlsbad, New Mexico, and the Yucca Mountain Site, Southern Nevada II (<i>GSA Hydrogeology Division; U.S. Department of Energy; GSA Geology and Public Policy Committee</i>)	203
39	1:30 p.m.	T50. Marine Hard Substrates: Colonization and Evolution (<i>Paleontological Society; GSA Sedimentary Geology Division</i>)	709/71
40	1:30 p.m.	T67. Advanced Characterization of the Structures and Behaviors of Minerals (<i>Mineralogical Society of America</i>)	605
41	1:30 p.m.	T71. Granitic Pegmatites: Recent Advances in Mineralogy, Petrology, and Understanding II (<i>Mineralogical Society of America</i>)	607
42	1:30 p.m.	T77. Pre-EarthScope Synthesis of the Rocky Mountains I and II: Surface Processes, Geodynamics, and the Roles of Neotectonics and Climate in Development of Modern Topography (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division; GSA Quaternary Geology and Geomorphology Division; Rocky Mountain Association of Geologists; Colorado Scientific Society; EarthScope</i>)	108/110/112
43	1:30 p.m.	T84. Terrane Translation, Orogenesis, and Plate Interactions in the Late Mesozoic to Early Cenozoic North American Cordillera, and Implications for Paleogeographic Reconstructions (<i>GSA Geophysics Division; GSA Structural Geology and Tectonics Division</i>)	104/106
44	1:30 p.m.	T102. Quaternary Paleoenvironments of the Middle East: Proxy Records, Human Prehistory, and Regional Cross-Correlation (<i>GSA Archaeological Geology Division; GSA Quaternary Geology and Geomorphology Division</i>)	107/109
45	1:30 p.m.	T114. Geology in the National Parks: Research, Mapping, and Resource Management II (<i>National Park Service</i>)	201
46	1:30 p.m.	T126. Teaching Geology and Human Health: Expanding the Curriculum (<i>National Association of Geoscience Teachers; GSA Geoscience Education Division</i>)	603
47	1:30 p.m.	Big Bend (Posters)	Exhibit Hall
48	1:30 p.m.	Geoscience Information/Communication (Posters)	Exhibit Hall
49	1:30 p.m.	Hydrogeology (Posters) I	Exhibit Hall
50	1:30 p.m.	Metamorphic Petrology (Posters)	Exhibit Hall
51	1:30 p.m.	Neotectonics/Paleoseismology (Posters)	Exhibit Hall
52	1:30 p.m.	Planetary Geology (Posters)	Exhibit Hall
53	1:30 p.m.	Remote Sensing/Geographic Info System (Posters)	Exhibit Hall
54	1:30 p.m.	T7. The Occurrence, Storage, and Flow of Groundwater in Mountainous Terrain (Posters) (<i>GSA Hydrogeology Division; U.S. Geological Survey; American Geophysical Union Hydrology Section</i>)	Exhibit Hall
55	1:30 p.m.	T70. Modeling Grain-Scale Processes in Metamorphic Rocks (Posters) (<i>Mineralogical Society of America; GSA Structural Geology and Tectonics Division</i>)	Exhibit Hall
56	1:30 p.m.	T72. Impact Geology (Posters) (<i>GSA Planetary Geology Division; GSA Sedimentary Geology Division</i>)	Exhibit Hall
57	1:30 p.m.	T75. A Xenolith Perspective on the Physical and Chemical Evolution of Continental Lithosphere (Posters) (<i>GSA Structural Geology and Tectonics Division; Mineralogical Society of America; GSA Geophysics Division</i>)	Exhibit Hall



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Volume 32, May 2004

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NO.	TIME	DESCRIPTION (<i>SPONSORS</i>)	LOCATION
58	1:30 p.m.	T85. Whence the Mountains? New Developments in the Tectonic Evolution of Orogenic Belts: Celebrating the Dynamic Career of Raymond A. Price at the 50-Year Mark (Posters) (<i>GSA Structural Geology and Tectonics Division; Geological Association of Canada</i>)	Exhibit Hall
59	1:30 p.m.	T92. Neotectonics and Earthquake Potential of the Eastern Mediterranean Region (Posters) (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division</i>)	Exhibit Hall
60	1:30 p.m.	T94. Geoinformatics and Geological Sciences: The Next Step (Posters) (<i>GSA Geophysics Division</i>)	Exhibit Hall
61	1:30 p.m.	T112. Geologic Time and CHRONOS: Databases, Tools, Outreach, Education, and the Geoinformatics Revolution (Posters) (<i>Geoscience Information Society; Paleontological Society; CHRONOS</i>)	Exhibit Hall
62	6:30 p.m.	T124. Using Field Observations and Field Experiences to Teach Geoscience: An Illustrated Community Discussion (Posters) (<i>National Association of Geoscience Teachers; GSA Education Division</i>)	Exhibit Hall
63	1:30 p.m.	T143. Pre-Mesozoic Impacts: Their Effect on Ocean Geochemistry, Magnetic Polarity, Climate Change, and Organic Evolution (Posters) (<i>GSA Planetary Geology Division; Paleontological Society</i>)	Exhibit Hall

MONDAY, NOVEMBER 8, 2004

64	8 a.m.	Environmental Geoscience I	709/711
65	8 a.m.	Geochemistry II: Organic Geochemistry	705/707
66	8 a.m.	Geomorphology II	107/109
67	8 a.m.	Geophysics/Tectonophysics/Seismology: From Groundwater to North American Tectonics	102
68	8 a.m.	Hydrogeology I: Flow and Transport Simulations	207
69	8 a.m.	Paleontology IV: Mass Extinctions and Their Consequences	702/704/706
70	8 a.m.	Structural Geology I: Cordilleran Structures to Hydraulic Fracturing	104/106
71	8 a.m.	P5. Adversity, Advantages, Opportunities: Phanerozoic Stromatolites as "Survivor" vs. "Disaster" Taxa (<i>Paleontological Society; GSA Geobiology and Geomicrobiology Division</i>)	Ballroom 2 & 3
72	8 a.m.	T6. Hydrologic Impacts of Urbanization and Suburbanization on Water Resources (<i>GSA Hydrogeology Division; GSA Engineering Geology Division</i>)	205

Halbouty Distinguished Lecture to be Presented during the GSA Annual Meeting in Denver



The 2004 Halbouty Distinguished Lecturer, Richard R. Parizek of Pennsylvania State University and Richard R. Parizek and Associates, will present his lecture, "Coal vs. Nuclear Energy: Hydrogeologic Perspectives" at the 2004 GSA Annual Meeting in Denver. Add this special presentation to your personal schedule. You won't want to miss it.

2004 Halbouty Distinguished Lecture
Colorado Convention Center, Room 108/110/112
Mon., Nov. 8, 1:30–2:30 p.m.

The Michel T. Halbouty Distinguished Lecturer was selected from abstracts submitted in the Engineering Geology discipline for the 2004 GSA Annual Meeting.

New Day, New Time, New Location, and
New Format

GSA Presidential Address and Awards Ceremony

Sat., Nov. 6, 7–9 p.m.

Hyatt Regency, Grand Ballroom

Join us Saturday night to hear Rob Van der Voo's Presidential Address, "Paleomagnetism, oroclines, and growth of the continental crust" followed by the citations and responses for GSA's Penrose, Day, and Donath medals, the American Geological Institute's Medal in Memory of Ian Campbell, the GSA Public Service Award, and GSA's two Distinguished Service Awards.

Please join us in recognizing all of our award recipients, including GSA Division award recipients and GSA's newly elected Fellows and Honorary Fellows on stage, followed by a cash bar reception. We hope to see you all at what we anticipate to be a wonderful evening.

NO.	TIME	DESCRIPTION (<i>SPONSORS</i>)	LOCATION
73	8 a.m.	T10. Comprehensive Monitoring Approaches at Regional and Statewide Levels—Advantages and Limitations (<i>GSA Hydrogeology Division; Association of Ground Water Scientists and Engineers, a Division of the National Ground Water Association</i>)	203
74	8 a.m.	T24. Organic Compounds in Near-Surface Environments as Drivers on the Redox-Reaction Highway: A Tribute to the Career of Mary Jo Baedeker (<i>GSA Hydrogeology Division</i>)	201
75	8 a.m.	T29. From Subterranean Crawlways to Scientific Hallways: Research on Our Public Cave and Karst Lands (<i>GSA Quaternary Geology and Geomorphology Division; National Park Service; National Cave and Karst Research Institute</i>)	607
76	8 a.m.	T41. The Gulf of Mexico—Past, Present, and Future: Relating Ecology to Geology (<i>GSA Quaternary Geology and Geomorphology Division; GSA Sedimentary Geology Division</i>)	103/105
77	8 a.m.	T57. The Concept of Layer-Cake Stratigraphy—Then and Now (<i>GSA History of Geology Division; GSA Sedimentary Geology Division</i>)	601
78	8 a.m.	T61. Frontier in Understanding the Geologic Record of Climate Change: A Session in Honor of William W. Hay (<i>GSA Sedimentary Geology Division; GSA Geobiology and Geomicrobiology Division; GSA Limnogeology Division; GSA Structural Geology and Tectonics Division</i>)	603
79	8 a.m.	T64. Genetic Links among Syngenetic Metal Accumulations in Sedimentary Basins: Giant Sediment-Hosted Metal Deposits to Metalliferous Black Shales (<i>Society of Economic Geologists</i>)	703
80	8 a.m.	T70. Modeling Grain-Scale Processes in Metamorphic Rocks (<i>Mineralogical Society of America; GSA Structural Geology and Tectonics Division</i>)	111/113
81	8 a.m.	T72. Impact Geology I (<i>GSA Planetary Geology Division; GSA Sedimentary Geology Division</i>)	605
82	8 a.m.	T74. 1500 to 2500 Ma: A Period of Changing Mantle Regimes in Earth History? (<i>Precambrian [At Large]; GSA Geophysics Division</i>)	708/710/712
83	8 a.m.	T85. Whence the Mountains? New Developments in the Tectonic Evolution of Orogenic Belts: Celebrating the Dynamic Career of Raymond A. Price at the 50-Year Mark I (<i>GSA Structural Geology and Tectonics Division; Geological Association of Canada</i>)	108/110/112
84	8 a.m.	T112. Geologic Time and CHRONOS: Databases, Tools, Outreach, Education, and the Geoinformatics Revolution I (<i>Geoscience Information Society; Paleontological Society; CHRONOS</i>)	Ballroom 4
85	8 a.m.	Archaeological Geology (Posters)	Exhibit Hall
86	8 a.m.	Coal Geology (Posters)	Exhibit Hall
87	8 a.m.	Geoscience Education (Posters)	Exhibit Hall
88	8 a.m.	Igneous Petrology (Posters)	Exhibit Hall
89	8 a.m.	Mineralogy/Crystallography (Posters)	Exhibit Hall
90	8 a.m.	T62. Wild Coal Fires: Burning Questions with Global Consequences? (Posters) (<i>GSA Coal Geology Division</i>)	Exhibit Hall
91	8 a.m.	T69. Looking Forward to the Past: A Session in Honor of Paul Ribbe and the Reviews in Mineralogy and Geochemistry (Posters) (<i>Mineralogical Society of America</i>)	Exhibit Hall
92	8 a.m.	T114. Geology in the National Parks: Research, Mapping, and Resource Management (Posters) (<i>National Park Service</i>)	Exhibit Hall
93	8 a.m.	T120. Integrative Interdisciplinary Undergraduate Research in the Earth Sciences (Posters) (<i>Council on Undergraduate Research, Geosciences Division</i>)	Exhibit Hall
94	8 a.m.	T121. Involvement of Undergraduates in Geological Research: Critical Tools for Background Enrichment (Posters) (<i>GSA Geoscience Education Division</i>)	Exhibit Hall
95	8 a.m.	T132. Why Earth Science Curriculum: National Science Foundation—Funded Projects for Improving Earth Science Education (Posters) (<i>GSA Geoscience Education Division; American Geological Institute; National Science Foundation</i>)	Exhibit Hall
96	8 a.m.	T134. We Can Do Better: Alternatives to the Same Old Lab-Lecture Format in the College Classroom (Posters) (<i>GSA Geoscience Education Division; National Association of Geoscience Teachers</i>)	Exhibit Hall
97	8 a.m.	T137. Minorities, Women, and Persons with Disabilities in the Geosciences: Continuing Issues and Innovative Solutions (Posters) (<i>GSA Geoscience Education Division; GSA Committee on Minorities and Women in the Geosciences</i>)	Exhibit Hall
98	1:30 p.m.	Archaeological Geology I	703

NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
99	1:30 p.m.	Environmental Geoscience II	201
100	1:30 p.m.	History of Geology	605
101	1:30 p.m.	Igneous Petrology	107/109
102	1:30 p.m.	Quaternary Geology II	705/707
103	1:30 p.m.	Sediments, Carbonates	203
104	1:30 p.m.	Structural Geology II: From Fractures to Shear Zones to Mantle Fabrics	709/711
105	1:30 p.m.	P1. Early Paleoproterozoic (2.5–2.0 Ga) Events and Rates: Bridging Field Studies and Models (<i>Geochemical Society; Astrobiology Program; GSA Sedimentary Geology Division; SEPM—Society for Sedimentary Geology</i>)	Ballroom 2 & 3
106	1:30 p.m.	T28. New Perspectives in Karst Geomicrobiology and Redox Geochemistry (<i>GSA Hydrogeology Division; Karst Waters Institute; GSA Geobiology and Geomicrobiology Division</i>)	205
107	1:30 p.m.	T48. Unraveling the History of Ocean Crust Production: Evidence For and Against Changes in Seafloor Spreading Rates Since the Mesozoic	102
108	1:30 p.m.	T68. Nano-Geochemistry and Nano-Structures in Earth Systems (<i>GSA Geobiology and Geomicrobiology Division</i>)	104/106
109	1:30 p.m.	T69. Looking Forward to the Past: A Session in Honor of Paul Ribbe and the Reviews in Mineralogy and Geochemistry I (<i>Mineralogical Society of America</i>)	103/105
110	1:30 p.m.	T72. Impact Geology II (<i>GSA Planetary Geology Division; GSA Sedimentary Geology Division</i>)	111/113
111	1:30 p.m.	T78. Pre-EarthScope Synthesis of the Rocky Mountains III: New Advances in Laramide Deformation and Tectonics of Rocky Mountain Basement-Involved Structures: In Honor of Donald L. Blackstone Jr. (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division; Wyoming Geological Association; Rocky Mountain Association of Geologists; Colorado Scientific Society; EarthScope</i>)	702/704/706
112	1:30 p.m.	T85. Whence the Mountains? New Developments in the Tectonic Evolution of Orogenic Belts: Celebrating the Dynamic Career of Raymond A. Price at the 50-Year Mark II (<i>GSA Structural Geology and Tectonics Division; Geological Association of Canada</i>)	708/710/712
113	1:30 p.m.	T112. Geologic Time and CHRONOS: Databases, Tools, Outreach, Education, and the Geoinformatics Revolution II (<i>Geoscience Information Society; Paleontological Society; CHRONOS</i>)	Ballroom 4
114	1:30 p.m.	T118. The Science of Sustainability: How Can We Most Effectively Educate Students, the Public, and Policymakers? (<i>GSA Critical Issues Caucus; GSA Geology and Public Policy Committee</i>)	607
115	1:30 p.m.	T134. We Can Do Better: Alternatives to the Same Old Lab-Lecture Format in the College Classroom (<i>GSA Geoscience Education Division; National Association of Geoscience Teachers</i>)	601
116	1:30 p.m.	T137. Minorities, Women, and Persons with Disabilities in the Geosciences: Continuing Issues and Innovative Solutions (<i>GSA Geoscience Education Division; GSA Committee on Minorities and Women in the Geosciences</i>)	603
117	1:30 p.m.	Engineering Geology (Posters)	Exhibit Hall
118	1:30 p.m.	Geomorphology (Posters)	Exhibit Hall
119	1:30 p.m.	Limnogeology (Posters)	Exhibit Hall
120	1:30 p.m.	Marine/Coastal Science (Posters)	Exhibit Hall
121	1:30 p.m.	Paleoclimatology/Paleoceanography (Posters)	Exhibit Hall
122	1:30 p.m.	T33. Geologic Disposal of Radioactive Waste: Rising to the Challenge of Regulatory Requirements and Environmental Protection at the Waste Isolation Pilot Plant (WIPP) Near Carlsbad, New Mexico, and the Yucca Mountain Site, Southern Nevada (Posters) (<i>GSA Hydrogeology Division; U.S. Department of Energy; GSA Geology and Public Policy Committee</i>)	Exhibit Hall
123	1:30 p.m.	T37. GIS, GPS, and Remote Sensing in Geologic Hazard Assessment (Posters) (<i>GSA Engineering Geology Division</i>)	Exhibit Hall
124	1:30 p.m.	T41. The Gulf of Mexico—Past, Present, and Future: Relating Ecology to Geology (Posters) (<i>GSA Quaternary Geology and Geomorphology Division; GSA Sedimentary Geology Division</i>)	Exhibit Hall
125	1:30 p.m.	T61. Frontiers in Understanding the Geologic Record of Climate Change: A Session in Honor of William W. Hay (Posters) (<i>GSA Sedimentary Geology Division; GSA Geobiology and Geomicrobiology Division; GSA Limnogeology Division; GSA Structural Geology and Tectonics Division</i>)	Exhibit Hall

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NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
126	1:30 p.m.	T95. Differentiating Climatic from Tectonic Controls on Landscape Evolution (Posters) (GSA Quaternary Geology and Geomorphology Division; GSA Structural Geology and Tectonics Division)	Exhibit Hall

TUESDAY, NOVEMBER 9, 2004

127	8 a.m.	Archaeological Geology II	102
128	8 a.m.	Hydrogeology II: Process Investigations	207
129	8 a.m.	Paleontology V: Fossil Gradients and Ecological Landscapes	108/110/112
130	8 a.m.	Paleontology VI: Quantitative and Analytical Morphology	111/113
131	8 a.m.	Tectonics II: Central Cordillera to the Middle and Far East	705/707
132	8 a.m.	P2. Geoinformatics and the Role of Cyberinfrastructure in Geosciences Research	Ballroom 2 & 3
133	8 a.m.	P6. Pre-Mesozoic Impacts: Their Effect on Ocean Geochemistry, Magnetic Polarity, Climate Change, and Organic Evolution (GSA Planetary Geology Division; Paleontological Society; GSA Geobiology and Geomicrobiology Division)	Ballroom 4
134	8 a.m.	T4. Over 40 Years of Influence in Environmental Hydrogeology: In Honor of Dick Parizek I (GSA Hydrogeology Division)	203
135	8 a.m.	T13. Modeling Flow and Transport in Chemically and Physically Heterogeneous Media I (GSA Hydrogeology Division)	201
136	8 a.m.	T19. Innovative Tracer Applications in Hydrogeology: New Techniques, Design and Interpretation Methods, and Case Studies I (GSA Hydrogeology Division; International Association of Hydrogeologists—International Commission on Tracers)	205
137	8 a.m.	T21. Vadose Zone Nitrogen: Sources, Fate, and Transport (GSA Hydrogeology Division; GSA Geobiology and Geomicrobiology Division)	607

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FREE WORKSHOP!

**GSA Research Grant Proposal
Writing Workshop**
Colorado Convention Center, Room 703
Tues., Nov. 9, noon–1 pm

If you are interested in improving your chances of receiving a GSA student research grant or are looking for tips to improve your proposal writing for future funding, join GSA's first proposal-writing workshop aimed specifically at graduate students. Led by a member of the GSA Research Grant Committee, this workshop is based on recent GSA graduate research grant proposals and will put several examples into hypothesis-driven studies, providing examples of the dos and don'ts of the proposal-writing process. A brief overview of the review process by the GSA research grant committee will also be outlined. Space is limited to 100 people, so please show up early and bring your questions and lunch!

NO.	TIME	DESCRIPTION (<i>SPONSORS</i>)	LOCATION
138	8 a.m.	T37. GIS, GPS, and Remote Sensing in Geologic Hazard Assessment (<i>GSA Engineering Geology Division</i>)	605
139	8 a.m.	T39. Current Perspectives in Environmental Biogeochemistry I (<i>GSA Hydrogeology Division; GSA Geobiology and Geomicrobiology Division</i>)	107/109
140	8 a.m.	T55. Anatomy of an Anachronistic Period: The Early Triassic Environment and its Effect on the History of Life (<i>Paleontological Society; GSA Sedimentary Geology Division</i>)	104/106
141	8 a.m.	T69. Looking Forward to the Past: A Session in Honor of Paul Ribbe and the Reviews in Mineralogy and Geochemistry II (<i>Mineralogical Society of America</i>)	708/710/712
142	8 a.m.	T73. Early Paleoproterozoic (2.5–2.0 Ga) Events and Rates: Bridging Field Studies and Models (<i>Precambrian [At Large]; Geochemical Society; GSA Sedimentary Geology Division; SEPM—Society for Sedimentary Geology; Astrobiology Program</i>)	709/711
143	8 a.m.	T83. Cordilleran Arc Magmatism, BATHOLITHS and Continental Crustal Genesis I (<i>GSA Geophysics Division; GSA Structural Geology and Tectonics Division</i>)	702/704/706
144	8 a.m.	T96. Records of Late Quaternary Climatic Change from the Americas: Interhemispheric Synchronicity or Not (<i>GSA Quaternary Geology and Geomorphology Division</i>)	103/105
145	8 a.m.	T123. Teaching Structural Geology in the 21st Century (<i>GSA Structural Geology and Tectonics Division; National Association of Geoscience Teachers; On the Cutting Edge</i>)	703
146	8 a.m.	T127. STEMS: Science Teaching Enhanced with Museums and Surveys (<i>GSA Geoscience Education Division; National Association of Geoscience Teachers</i>)	601
147	8 a.m.	T142. Building Strong Geoscience Departments: Opportunities, Successes, and Challenges (<i>National Association of Geoscience Teachers; GSA Geoscience Education Division</i>)	603
148	8 a.m.	Economic Geology (Posters)	Exhibit Hall
149	8 a.m.	Geochemistry, Aqueous (Posters)	Exhibit Hall
150	8 a.m.	Geochemistry, Other (Posters): Hydrothermal and Igneous Geochemistry	Exhibit Hall
151	8 a.m.	Geomicrobiology (Posters): Microbe-Mineral Interactions, Life in Extreme Environments, and Early Microbial Life on Earth I	Exhibit Hall
152	8 a.m.	Paleontology (Posters) II: Biogeography/Biostratigraphy	Exhibit Hall
153	8 a.m.	Paleontology (Posters) III: Diversity, Extinction, Origination	Exhibit Hall
154	8 a.m.	Sediments, Carbonates (Posters)	Exhibit Hall
155	8 a.m.	Sediments, Clastic (Posters)	Exhibit Hall
156	8 a.m.	T47. Ocean Chemistry through the Precambrian and Paleozoic (Posters) (<i>GSA Sedimentary Geology Division</i>)	Exhibit Hall
157	8 a.m.	T60. Sedimentary Geology and Earth History: Retrospective and Prospective: In Honor of the Career and Contributions of Robert H. Dott Jr. (Posters) (<i>GSA Sedimentary Geology Division; GSA History of Geology Division</i>)	Exhibit Hall
158	8 a.m.	T71. Granitic Pegmatites: Recent Advances in Mineralogy, Petrology, and Understanding (Posters) (<i>Mineralogical Society of America</i>)	Exhibit Hall
159	2:30 p.m.	Geochemical Society Ingerson Lecture	709/711
160	4:00 p.m.	MSA Presidential Address	709/711
161	1:30 p.m.	Paleontology VII: Organismal Interactions and Behavior	111/113
162	1:30 p.m.	Paleontology VIII: Processes of Fossilization	108/110/112
163	1:30 p.m.	Remote Sensing/Geographic Information System	703
164	1:30 p.m.	P8. Weathering, Slopes, Climate, and Late-Quaternary Geomorphic Change in Arid and Semi-Arid Landscapes (<i>GSA Quaternary Geology and Geomorphology Division</i>)	Ballroom 2 & 3
165	1:30 p.m.	T4. Over 40 Years of Influence in Environmental Hydrogeology: In Honor of Dick Parizek II (<i>GSA Hydrogeology Division</i>)	203
166	1:30 p.m.	T9. Sustainable Management of Water Resources (<i>International Association of Hydrogeologists/ U.S. National Chapter; GSA Geology and Public Policy Committee</i>)	102
167	1:30 p.m.	T12. Fluid Flow and Solute Transport in Fractured Rocks (<i>GSA Hydrogeology Division</i>)	207
168	1:30 p.m.	T13. Modeling Flow and Transport in Chemically and Physically Heterogeneous Media II (<i>GSA Hydrogeology Division</i>)	201

NO.	TIME	DESCRIPTION (<i>SPONSORS</i>)	LOCATION
169	1:30 p.m.	T19. Innovative Tracer Applications in Hydrogeology: New Techniques, Design and Interpretation Methods, and Case Studies II (<i>GSA Hydrogeology Division; International Association of Hydrogeologists—International Commission on Tracers</i>)	205
170	1:30 p.m.	T39. Current Perspectives in Environmental Biogeochemistry II (<i>GSA Hydrogeology Division; GSA Geobiology and Geomicrobiology Division</i>)	107/109
171	1:30 p.m.	T51. Protistan Paleobiodiversity: Understanding Evolutionary Patterns (<i>Cushman Foundation</i>)	104/106
172	1:30 p.m.	T60. Sedimentary Geology and Earth History: Retrospective and Prospective: In Honor of the Career and Contributions of Robert H. Dott Jr. (<i>GSA Sedimentary Geology Division; GSA History of Geology Division</i>)	103/105
173	1:30 p.m.	T80. Pre-EarthScope Synthesis of the Rocky Mountains V: New Insights in Basement Tectonics, Deep Crustal Structure, and Precambrian Tectonic Evolution (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division; Rocky Mountain Association of Geologists; Colorado Scientific Society; EarthScope</i>)	705/707
174	1:30 p.m.	T83. Cordilleran Arc Magmatism, BATHOLITHS and Continental Crustal Genesis II (<i>GSA Geophysics Division; GSA Structural Geology and Tectonics Division</i>)	702/704/706
175	1:30 p.m.	T85. Whence the Mountains? New Developments in the Tectonic Evolution of Orogenic Belts: Celebrating the Dynamic Career of Raymond A. Price at the 50-Year Mark III (<i>GSA Structural Geology and Tectonics Division; Geological Association of Canada</i>)	708/710/712
176	1:30 p.m.	T98. Evolution of the Great Plains Landscape (<i>GSA Quaternary Geology and Geomorphology Division</i>)	Ballroom 4
177	1:30 p.m.	T113. Geology in the National Forests—Stewardship, Education, and Research (<i>GSA Engineering Geology Division; USDA Forest Service, Minerals and Geology Management Program</i>)	607
178	1:30 p.m.	T116. Geology for the Masses: Engaging the Public through Informal Geoscience Education in Parks, Monuments, Open Spaces, and Public Lands (<i>GSA Geoscience Education Division; National Park Service; Bureau of Land Management; Association of Earth Science Editors</i>)	605
179	1:30 p.m.	T122. Inspiring First-Rate Research through Undergraduate Teaching: A Special Session in Honor of John B. Reid Jr. (<i>National Association of Geoscience Teachers; GSA Quaternary Geology and Geomorphology Division</i>)	601
180	1:30 p.m.	T130. Authentic Research Collaborations: Bringing Scientific Researchers, K–12 Schools, and Other Community Groups Together in the Scientific Endeavor (<i>GSA Geoscience Education Division; National Association of Geoscience Teachers</i>)	603
181	1:30 p.m.	Paleontology (Posters) IV: Phylogeny/Morphology	Exhibit Hall
182	1:30 p.m.	Structural Geology (Posters)	Exhibit Hall
183	1:30 p.m.	Volcanology (Posters)	Exhibit Hall
184	1:30 p.m.	T88. Thrust Belts and Plateaus: The Anatomy of Convergent Systems (Posters) (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division</i>)	Exhibit Hall
185	1:30 p.m.	T91. Paleomagnetism and Rock Magnetism Perspective of Shear Zone Kinematics (Posters) (<i>GSA Geophysics Division; GSA Structural Geology and Tectonics Division</i>)	Exhibit Hall
186	1:30 p.m.	T93. Crustal Seismic Anisotropy as a Measure of Regional Tectonic Deformation (Posters) (<i>GSA Geophysics Division; GSA Structural Geology and Tectonics Division</i>)	Exhibit Hall
187	1:30 p.m.	T123. Teaching Structural Geology in the 21st Century (Posters) (<i>GSA Structural Geology and Tectonics Division; National Association of Geoscience Teachers; On the Cutting Edge</i>)	Exhibit Hall
188	1:30 p.m.	T125. Using Digital Geological Maps to Build Deeper Understanding of Earth Science Relationships (Posters)	Exhibit Hall
189	1:30 p.m.	T141. Building a Digital Library that Supports Diversity: Goals, Lessons Learned, and Future Directions (Posters) (<i>National Association of Geoscience Teachers; Geoscience Information Society; GSA Geoscience Education Division</i>)	Exhibit Hall
190	1:30 p.m.	T142. Building Strong Geoscience Departments: Opportunities, Successes, and Challenges (Posters) (<i>National Association of Geoscience Teachers; GSA Geoscience Education Division</i>)	Exhibit Hall

WEDNESDAY, NOVEMBER 10, 2004

191	8 a.m.	Economic Geology I: Gold, Pb-Zn, and Iron Deposits and Isotopic Tracers	607
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NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
192	8 a.m.	Geochemistry III; Geochemistry of Isotopes and Fluids	709/711
193	8 a.m.	Geoscience Information/Communication	605
194	8 a.m.	Hydrogeology III: Hydrogeochemistry	203
195	8 a.m.	Metamorphic Petrology	705/707
196	8 a.m.	Paleontology IX: Perspectives on Diversity	108/110/112
197	8 a.m.	Precambrian Geology	703
198	8 a.m.	Sediments, Clastic: Petrology and Alluvial Architecture	103/105
199	8 a.m.	P7. Seeing Mars with New Eyes: Active Missions, Science Results, and Geoscience Education (GSA Planetary Geology Division; Geoscience Education Division)	Ballroom 2 & 3
200	8 a.m.	T8. Mountain Watershed Pollutant Transport and Water Quality Issues, Including Groundwater Surface-Water Interplay in Pollutant Transfer (GSA Hydrogeology Division)	207
201	8 a.m.	T17. Aquitard Studies: Understanding Geologic Constraints on Flow and Transport in Groundwater Flow Systems (GSA Hydrogeology Division)	205
202	8 a.m.	T20. Dissolved Gases as Indicators of Geochemical and Hydrogeologic Processes (GSA Hydrogeology Division; GSA Geobiology and Geomicrobiology Division)	201
203	8 a.m.	T42. Authigenic Minerals in Modern and Ancient Terrestrial Aquatic Environments (GSA Limnogeology Division; GSA Sedimentary Geology Division; GSA Geobiology and Geomicrobiology Division)	107/109
204	8 a.m.	T46. Biomineralization in Terrestrial Hot Springs: The Preservation of Thermophiles in Past and Present-Day Systems (GSA Geobiology and Geomicrobiology Division; GSA Sedimentary Geology Division)	111/113
205	8 a.m.	T47. Ocean Chemistry through the Precambrian and Paleozoic I (GSA Sedimentary Geology Division)	Ballroom 4
206	8 a.m.	T52. The Hunters and the Hunted: Predation On and By Gastropods (Paleontological Society)	104/106

NO.	TIME	DESCRIPTION (<i>SPONSORS</i>)	LOCATION
207	8 a.m.	T85. Whence the Mountains? New Developments in the Tectonic Evolution of Orogenic Belts: Celebrating the Dynamic Career of Raymond A. Price at the 50-Year Mark IV (<i>GSA Structural Geology and Tectonics Division; Geological Association of Canada</i>)	702/704/706
208	8 a.m.	T87. Recent Advances in Himalayan Geology (<i>GSA Structural Geology and Tectonics Division</i>)	708/710/712
209	8 a.m.	T106. Geological Context of Early Humans from Ethiopian Rift Basins (<i>GSA Archaeological Geology Division; GSA Sedimentary Geology Division; GSA Limnogeology Division</i>)	102
210	8 a.m.	T117. Innovative Approaches to Teaching “Geology of National Parks”: Tales from the Classroom, Field, Page, Web, and Beyond (<i>GSA Geoscience Education Division; National Association of Geoscience Teachers</i>)	603
211	8 a.m.	T136. Electronic Student Response Technology in the Geoscience Classroom: Is it a Valuable Teaching and Learning Tool? (<i>National Association of Geoscience Teachers; GSA Geoscience Education Division</i>)	601
212	8 a.m.	Environmental Geoscience (Posters) I	Exhibit Hall
213	8 a.m.	Geophysics/Tectonophysics/Seismology (Posters)	Exhibit Hall
214	8 a.m.	Quaternary Geology (Posters) II	Exhibit Hall
215	8 a.m.	Tectonics (Posters)	Exhibit Hall
216	8 a.m.	T39. Current Perspectives in Environmental Biogeochemistry (Posters) (<i>GSA Hydrogeology Division; GSA Geobiology and Geomicrobiology Division</i>)	Exhibit Hall
217	8 a.m.	T79. Pre-EarthScope Synthesis of the Rocky Mountains IV (Posters) (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division; Friends of the Ancestral Rocky Mountains; EarthScope</i>)	Exhibit Hall
218	8 a.m.	T81. Regional Geology of the Northern Rockies: A Session Honoring Betty Skipp (Posters) (<i>GSA Structural Geology and Tectonics Division; GSA Sedimentary Geology Division; SEPM—Society for Sedimentary Geology</i>)	Exhibit Hall
219	8 a.m.	T84. Terrane Translation, Orogenesis, and Plate Interactions in the Late Mesozoic to Early Cenozoic North American Cordillera, and Implications for Paleogeographic Reconstructions (Posters) (<i>GSA Geophysics Division; GSA Structural Geology and Tectonics Division</i>)	Exhibit Hall
220	8 a.m.	T96. Records of Late Quaternary Climatic Change from the Americas: Interhemispheric Synchronicity or Not (Posters) (<i>GSA Quaternary Geology and Geomorphology Division</i>)	Exhibit Hall
221	8 a.m.	T97. Geologic History and Processes of the Colorado River (Posters) (<i>GSA Quaternary Geology and Geomorphology Division</i>)	Exhibit Hall
222	1:30 p.m.	Economic Geology II: Copper Deposits	102
223	1:30 p.m.	Engineering Geology	201
224	1:30 p.m.	Geoscience Education II	603
225	1:30 p.m.	Paleontology X: Early Life	108/110/112
226	1:30 p.m.	Paleontology XI: Species Concepts and Phylogenetic Relationships	104/106
227	1:30 p.m.	Paleontology XII: The Ecologic Context of Taxonomic Turnover	111/113
228	1:30 p.m.	Public Policy: Decisionmakers, and the Public: Challenges in Communication	607
229	1:30 p.m.	Quaternary III	703
230	1:30 p.m.	Stratigraphy II: Glacial and Bedrock Stratigraphy	107/109
231	1:30 p.m.	Tectonics III: UHP Terranes, Ribbon Continents, Appalachians, and Mid-Continent	709/711
232	1:30 p.m.	T2. Upcoming Revolutions in Observing Systems: Implications for Hydrogeology (<i>GSA Hydrogeology Division</i>)	203
233	1:30 p.m.	T7. The Occurrence, Storage, and Flow of Groundwater in Mountainous Terrain (<i>GSA Hydrogeology Division; U.S. Geological Survey; American Geophysical Union Hydrology Section</i>)	205
234	1:30 p.m.	T35. Assessment and Characterization of Geologic Formations for Long-Term CO ₂ Storage (Sequestration) (<i>GSA Geology and Public Policy Committee</i>)	207
235	1:30 p.m.	T47. Ocean Chemistry through the Precambrian and Paleozoic II (<i>GSA Sedimentary Geology Division</i>)	Ballroom 4
236	1:30 p.m.	T81. Regional Geology of the Northern Rockies: A Session Honoring Betty Skipp (<i>GSA Structural Geology and Tectonics Division; GSA Sedimentary Geology Division; SEPM—Society for Sedimentary Geology</i>)	702/704/706
237	1:30 p.m.	T90. Low-angle Normal Faults and Faulting: Field Studies, Fault Rocks, Mechanics, and Weakening Mechanisms (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division</i>)	708/710/712

NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
238	1:30 p.m.	T97. Geologic History and Processes of the Colorado River (<i>GSA Quaternary Geology and Geomorphology Division</i>)	705/707
239	1:30 p.m.	T115. The Keys to Opportunities with the National Park Service (<i>National Park Service; Geological Society of America; American Geological Institute; Association for Women Geoscientists</i>)	605
240	1:30 p.m.	T133. Current Research on Situated Teaching and Learning in Geoscience: Field-Based, Case-Based, Problem-Based, Place-Based (<i>National Association of Geoscience Teachers; GSA Geoscience Education Division</i>)	601
241	1:30 p.m.	T144. Mars Mineralogy: The View from MER (<i>Mineralogical Society of America; GSA Planetary Geology Division</i>)	103/105
242	1:30 p.m.	Environmental Geoscience (Posters) II	Exhibit Hall
243	1:30 p.m.	Hydrogeology (Posters) II	Exhibit Hall
244	1:30 p.m.	Precambrian Geology (Posters)	Exhibit Hall
245	1:30 p.m.	T9. Sustainable Management of Water Resources (Posters) (<i>International Association of Hydrogeologists/U.S. National Chapter; GSA Geology and Public Policy Committee</i>)	Exhibit Hall
246	1:30 p.m.	T13. Modeling Flow and Transport in Chemically and Physically Heterogeneous Media (Posters) (<i>GSA Hydrogeology Division</i>)	Exhibit Hall
247	1:30 p.m.	T20. Dissolved Gases as Indicators of Geochemical and Hydrogeologic Processes (Posters) (<i>GSA Hydrogeology Division; GSA Geobiology and Geomicrobiology Division</i>)	Exhibit Hall
248	1:30 p.m.	T24. Organic Compounds in Near-Surface Environments as Drivers on the Redox-Reaction Highway: A Tribute to the Career of Mary Jo Baedecker (Posters) (<i>GSA Hydrogeology Division</i>)	Exhibit Hall
249	1:30 p.m.	T32. Geological Mapping: Providing for Successful Water and Land Resource Planning (Posters) (<i>GSA Quaternary Geology and Geomorphology Division; GSA Engineering Geology Division; GSA Geology and Society Division; GSA Geology and Public Policy Committee; GSA Hydrogeology Division; Association of American State Geologists</i>)	Exhibit Hall

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Colorado Convention Center, Exhibit Hall

Sun., Nov. 7, 8 a.m.–7:30 p.m.; Mon.–Wed., Nov. 8–10, 8 a.m.–5:30 p.m.

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For a complete list of schools, contact Kevin Ricker, (303) 357-1090 or kricker@geosociety.org.

To check if a school has a booth in the Exhibit Hall, go to www.geosociety.org/meetings/2004/exhibits.htm.

INSTITUTION	SUN.	MON.	TUES.	WED.	INSTITUTION	SUN.	MON.	TUES.	WED.
California State University–Fullerton		⊙	⊙		University of California at Davis	⊙	⊙	⊙	
Clemson University		⊙			University of Chicago	⊙			
Cornell		⊙	⊙		University of Colorado–Boulder	⊙	⊙		
Duke University	⊙	⊙	⊙	⊙	University of Connecticut	⊙			
East Carolina University	⊙	⊙			University of Delaware		⊙		
Idaho State University	⊙	⊙			University of Idaho		⊙		
Illinois State University	⊙	⊙			University of Illinois		⊙		
Indiana University	⊙	⊙	⊙	⊙	University of Iowa	⊙			
Indiana University/Purdue University–Indianapolis	⊙				University of Kansas		⊙	⊙	
Iowa State University	⊙	⊙			University of Massachusetts	⊙	⊙		
Northern Arizona University	⊙	⊙			University of Missouri–Rolla		⊙		
Northwestern University		⊙	⊙		University of North Carolina–Chapel Hill	⊙	⊙		
Oklahoma State University	⊙	⊙	⊙		University of Oklahoma	⊙	⊙	⊙	
Oregon State University	⊙	⊙	⊙		University of Southern California	⊙	⊙	⊙	
Penn State University		⊙			University of Tennessee–Knoxville	⊙	⊙		
Rice University		⊙	⊙		University of Texas–El Paso	⊙	⊙	⊙	
Rosenstiel School–University of Miami		⊙			University of Toledo	⊙			
Rutgers University		⊙	⊙		University of Toronto	⊙	⊙		
SUNY–Binghamton		⊙			University of Wisconsin–Madison	⊙	⊙	⊙	
Syracuse University	⊙	⊙			Vanderbilt University	⊙	⊙		
Texas A&M University	⊙	⊙			Virginia Tech	⊙	⊙	⊙	
Texas Tech University	⊙	⊙			Yale University	⊙	⊙		
University of Arkansas	⊙	⊙	⊙						

~ Registration ~

You can still register online, by mail, or by fax until October 28 at on-site rates. (Standard registration ended September 30.)

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Registrations will not be accepted via mail, fax, or phone after October 28. You will need to register on-site at the Colorado Convention Center, Lobby B starting Saturday, Nov. 6 at 7 a.m.

Did you register before September 30?

If you are located within the United States, your confirmation and badge will be mailed to you approximately 2 weeks before the meeting. **IMPORTANT: Remember to bring your badge and registration confirmation with you to the meeting.** Badge holders and programs will be available in the Colorado Convention Center, Lobby B beginning Saturday, Nov. 6, at 7 a.m. For your convenience, a pick-up desk with badge holders and programs will also be available in the Marriott City Center and the Hyatt Regency Hotels.

Did you register after September 30, or are you located outside the United States?

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SuperShuttle—(303) 370-1300, (800) BLUE-VAN (258-3826), (800) 525-3177, or online at www.supershuttle.com.

Shuttles operate daily from 4:30 a.m. until midnight, serving all downtown hotels to/from DIA for \$18 each way or \$28 round-trip (for a special round-trip rate for the GSA Meeting, please bring the coupon

on this page, or print it out from the GSA Meeting Web site). Travel time is 45 minutes to one hour depending on hotels and number of stops. To arrange passage, stop at the SuperShuttle counter on Level 5 at the airport, or order service from a hotel doorman. Shuttles will stop at the Convention Center with advance reservation (2 hour minimum notice).

Taxis


East Terminal, exit door 507, West Terminal, exit door 510


Freedom Cab (303) 292-8900—up to 4 people
Metro Taxi (303) 333-3333—up to 5 people
Yellow Cab (303) 777-7777—up to 5 people

Rates: DIA to downtown: flat rate of \$43.00 + \$2.50 gate fee

Wheelchair-Accessible Buses, Shuttles, Taxis, or Vans

All of RTD's SkyRide buses are wheelchair accessible. SuperShuttle, Yellow Taxi, and Metro Taxi have accessible vehicles and can provide assistance for limited numbers with prior notice and reservation. The following companies will pick-up with prior notice at DIA and provide specialized transportation:





DENVER

GSA

November 7 - 10, 2004

Downtown Hotels
No reservations needed from the airport


Special Fare

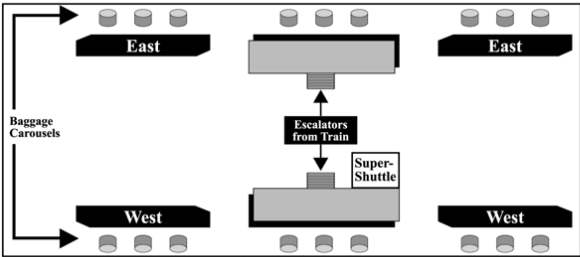
This coupon valid for a special fare of \$28 round trip per person or \$18 one way per person

TO BE PAID BY THE PASSENGER

MAJOR CREDIT CARDS ACCEPTED

Present this coupon at the SuperShuttle Denver counter on the Baggage Claim Level of DIA.





SuperShuttle Denver Denver International Airport Baggage Claim Level (Level 5)

DIA arrival information

Take the train from the concourse to the terminal.

Proceed to the SuperShuttle Denver counter to get a ticket

Counter is open 7:00 AM to 12:00 Midnight

Pick up luggage from the carousels.

Go out Door 510 and proceed to Lane 3

Mobility Transportation and Service Inc.
(303) 295-3900

Mobile Access
(303) 274-9895

Wheelchair Getaways
(303) 674-1498
(Rental vans—\$89.00 per day)

Public Bus Transportation Services

Regional Transportation District (RTD), (303) 299-6000, (wheelchair accessible) buses are available outside Level 5, door 511, on the East Terminal. Route information is available at the RTD booth on Level 5. Downtown Denver is serviced by Route AF.

Route AF/Downtown Service: Buses leave DIA for downtown Denver at 50 minutes past the hour from 6:50 a.m. to 12:50 a.m. The route takes approximately 50 minutes and is \$8 each way or \$13 round-trip. Exact fare is required when boarding the bus. Round-trip tickets must be purchased in advance at the RTD sales office on Level 5. Stops are made at Stapleton, the Downing Street Light Rail Station, the Denver Bus Center, and Market Street Station, which is two blocks from Union Station.

Buses leave from the downtown Market Street Station to DIA at 30 minutes past the hour from 5:28 a.m. until 10:28 a.m. for the same fare.

For complete RTD route information, call (303) 299-6000 or visit them at www.rtd-denver.com.

TRANSPORTATION OPTIONS IN DENVER

GSA will NOT be providing shuttle service from the hotels to the Convention Center this year, but Denver does have the following inexpensive—or free—options for getting around downtown. Alternative arrangements to/from the GSA hotels and the Colorado Convention Center will be provided by GSA for the elderly or disabled. For more information, contact Tammy White, twhite@geosociety.org, (303) 357-1041.

Light Rail

Denver's Light Rail runs from some downtown Denver hotels to the Colorado Convention Center, the suburbs, Invesco Field at Mile High, the Pepsi Center, and much more. Catch the "C Line" to LoDo or the "D Line" to the heart of Downtown Denver. You must have a validated ticket before you board the Light Rail. To purchase a ticket, use the stainless-steel ticket vending machines (TVMs) located at each station. For more information, call (303) 628-9000 or visit them at www.rtd-denver.com.

16th Street Pedestrian Mall Shuttle Bus

The 16th Street Mall is located between Market and Broadway Streets in the heart of downtown Denver, just two blocks from the Colorado Convention Center. This mall is a 14-block-long pedestrian promenade lined with shops, restaurants and cafes, trees, street performers, and cart vendors. The 2,000 chairs and benches set along the mall near fountains and flowers make it the perfect

place to sit and watch Denver walk by. Traffic is banned from this street except for the shuttle buses. The 16th Street Mall Shuttle is a free service that runs in a continuous loop up and down the mall. The buses run every 1–2 minutes from 6 a.m.–10:30 p.m., then every half-hour until 12:55 a.m.

General Meeting Information

Accessibility for Registrants with Special Needs

GSA is committed to making the Annual Meeting accessible to all people interested in attending. If you need auxiliary aids or services because of a disability, check the appropriate box on the registration form. If you have suggestions or need further information, contact Kevin Ricker at kicker@geosociety.org, (303) 357-1090. Please let us know your needs by October 8.

Tourist Information

For general information about sightseeing, accommodations, restaurants, and shopping in Denver, visit www.denver.org, or see the GSA Meeting Web site, www.geosociety.org/meetings/2004/.

Weather and Climate

Denver is located just east of a high mountain barrier and a long distance from any moisture source. Denver has a mild, dry, and arid climate. The average temperature in November is 52 °F for a high and 25 °F for a low, with only .87 inches of precipitation for the month. Denver normally records over 300 days of sunshine a year.

Call for Applications:



Apply for the GSA–USGS Congressional Science Fellowship for 2005–2006

Opportunities to serve as a Congressional Science Fellow are rare, unique experiences. This position may be a good fit for you. It will enable you to work directly with national leaders and put your expertise and experience to work helping shape science and technology policy on Capitol Hill.

The Congressional Science Fellow will be selected from top competitors early in 2005. Prospective candidates should be GSA members with broad geoscience backgrounds and excellent written and oral communication skills. Minimum requirements are a master's degree with at least five years professional experience or a Ph.D. at the time of appointment.

If you possess this professional background, have experience in applying scientific knowledge to societal challenges, and share a passion for helping shape the future of the geoscience profession, GSA invites your application. The fellowship is open to U.S. citizens or permanent residents of the U.S.

Deadline to apply: January 21, 2005

For application information, visit www.geosociety.org/science/csf/index.htm, or contact Ginger Williams, GSA Headquarters, (303) 357-1040, gwilliams@geosociety.org.

L@@K Students!

President's Student Breakfast Reception

**Marriott City Center
Colorado Ballroom**
Sun., Nov. 7, 7–8:30 a.m.

Sponsored by

ExxonMobil
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Hosted by



GSA President **Rob Van der Voo** invites all students registered for the meeting to attend a *free* breakfast buffet sponsored by ExxonMobil Corporation.

Rob and members of the GSA leadership, as well as ExxonMobil staff members, will be on hand to answer questions and address student issues. This will also be a time to recognize the Subaru Outstanding Woman in Science awardee,

Costanza Bonadonna, as well as acknowledge other student division awardees and student research grant recipients.

Each student registered for the meeting will receive a complimentary ticket for the breakfast buffet. This is one of the most popular events at the meeting for students, and with good reason! Take this opportunity to network with fellow students, meet the officers of GSA, and recognize fellow student award recipients!

Guest Program

Guest Hospitality Suite

DENVER MARRIOTT CITY CENTER, MOLLY BROWN ROOM

SUN.–WED., NOV. 7–10, 8 A.M.–5:30 P.M.

We extend a warm welcome to all guests at the 2004 Annual Meeting in Denver! The guest or spouse registration fee of \$80 per person is for nongeologist spouses or friends of professional and/or student meeting registrants. Registered guests are invited to visit the Guest Hospitality Suite, a resource center with abundant information on Denver and the surrounding areas. Local experts will be on hand to answer your questions. Light refreshments will be served throughout the day. We hope you enjoy your stay in Denver.

Badges: While at the Colorado Convention Center and the Denver Marriott City Center, wear your GSA guest badge. It is required for admission to the Guest Hospitality Suite and Exhibit Hall.

Exhibit Hall: Guest registration includes access to the Exhibit Hall.

Refreshments: Refreshments in the Guest Hospitality Suite are reserved only for those who have paid the guest registration fee of \$80.

Technical Sessions: The guest registration fee does not provide access to technical sessions. Any guest wishing to see a specific presentation should sign in with the hostess in the Guest Hospitality Suite.

Tours

You must be registered for either the entire GSA meeting or the Guest Program in order to participate in guest tours, seminars, and activities.

All guest tours depart from and return to the Denver Marriott City Center. Please arrive 15 to 20 minutes before scheduled departure. The Denver area has a great deal to offer and the formal tours can only cover a small portion of what is available to see and do. You may enjoy visiting other area attractions with fellow guest attendees or go it alone on a self-guided tour. The Guest Hospitality Suite hostess and the Denver Metro Convention & Visitors Bureau representatives (desk in the main concourse of the Colorado Convention Center) can provide you with more information and activity suggestions.

Ticketed Tours

Tickets are being sold in advance for the following tours. However, please check in at Registration, located in Lobby B of the Colorado Convention Center, for ticket availability.

	TIME	COST
SUNDAY		
Beautiful Breckenridge	9 a.m.–4 p.m.	\$40
Highlights of Boulder	12:30–5:30 p.m.	\$26
MONDAY		
Rocky Mountain High	9 a.m.–5 p.m.	\$48
Rocky Mountain High with Lunch	9 a.m.–5 p.m.	\$58
Castle in the Sky	9 a.m.–1 p.m.	\$40
TUESDAY		
Western Grandeur	9 a.m.–5 p.m.	\$67
Pure Gold	8 a.m.–1 p.m.	\$37
Butterfly Pavilion	9 a.m.–1 p.m.	\$35

Seminars

Payment of the guest registration fee entitles you to also attend the Guest Seminars offered for no additional charge. Guest Program registrants are invited to attend the following seminars and workshops.

Jewelry by Beth Finesilver

Denver Marriott City Center, Denver V Room

Mon., Nov. 8, 10–11 a.m.

This well-known local jewelry craftsman's work is currently available in boutiques, galleries, and shops all over the United States. Her exquisite designs with impeccable stones come from a love since her teenage years for color and shape. She will discuss the quality of her work, her methods, and the stones she uses, which include turquoise, jasper, agate, coral, quartz, tourmaline, carnelian, onyx, amethyst, and lapis, to name a few. Beth will have many pieces of her jewelry on display and for sale. You'll be delighted with her creativity and the caliber of her work. There will be a drawing for a piece of her jewelry at the seminar.

Teas, Teas, and More Teas

Denver Marriott City Center, Denver V Room

Tues., Nov. 9, 10–11 a.m.

Our Celestial Seasonings tea expert will delight you with the history of tea, the tea-making process, and tastings of many different kinds of teas. She will also bring Celestial Seasonings teas and a few unique teapots from its gift shop for you to purchase.

Decorate Your Home with Ease

Denver Marriott City Center, Mattie Silks Room

Wed., Nov. 10, 10:30–noon

Learn how to decorate your home by using what you have. Janice Earhart, designer and owner of The Design Coach will teach you the five top decorating mistakes and ways to correct them. You will get great ideas and decorating tips you can use immediately. Janice works as a design coach and teaches at The Great Indoors and Guiry's Paint Store on color, design, and many other subjects. She was trained and certified by Lauri Ward, the pioneer in one-day redecorating in New York and is a certified member of the Interior Refiners Network.

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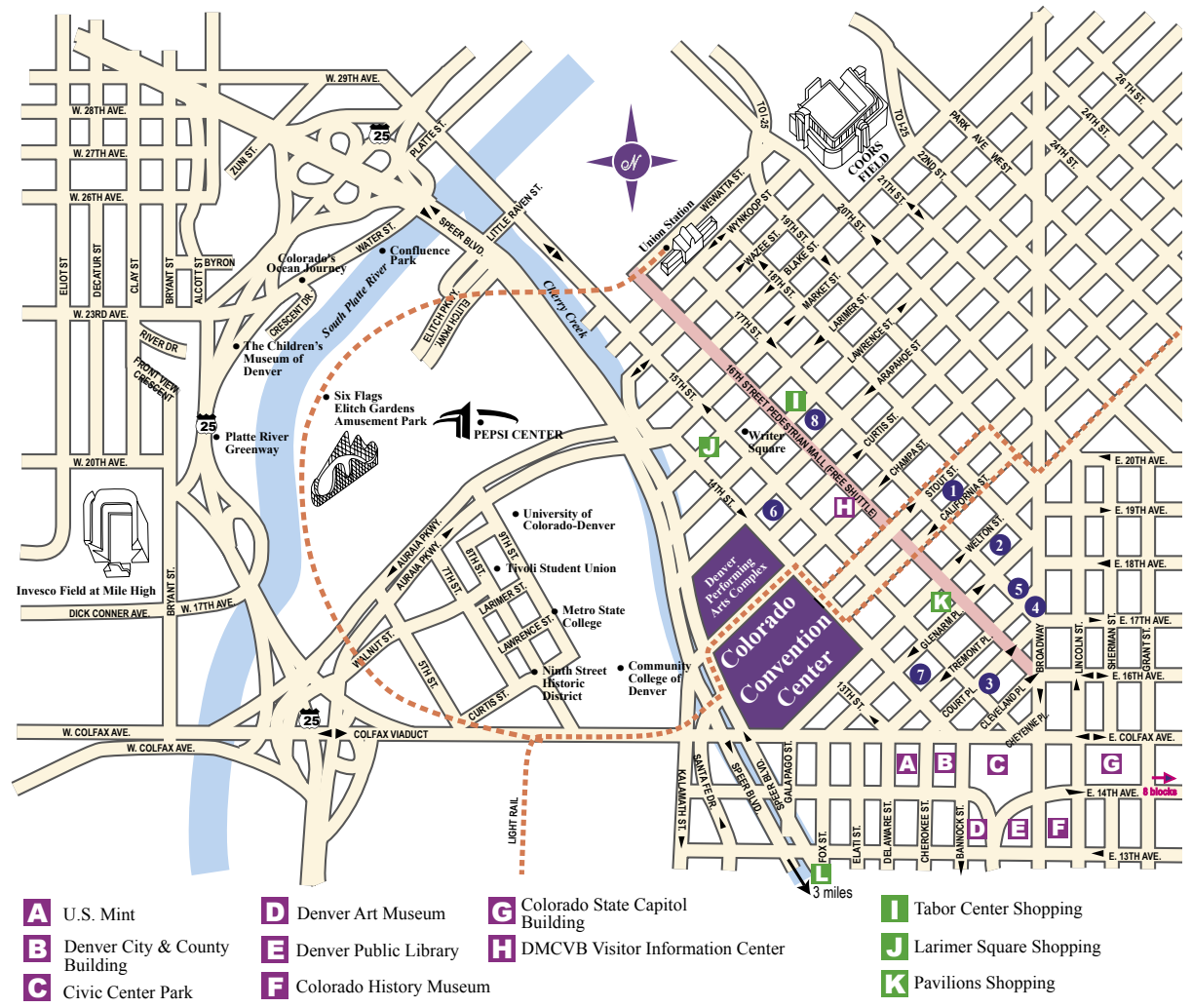
Breakfast with GSA's President and Executive Director

GUEST HOSPITALITY SUITE

Denver Marriott City Center, Restaurant Level, Molly Brown Room
Mon., Nov. 8, 8–8:30 a.m.

Come to the Guest Hospitality Suite to meet incoming GSA President William A. Thomas and GSA Executive Director Jack Hess. Breakfast will be provided for those guests who have paid the \$80 guest program registration fee.

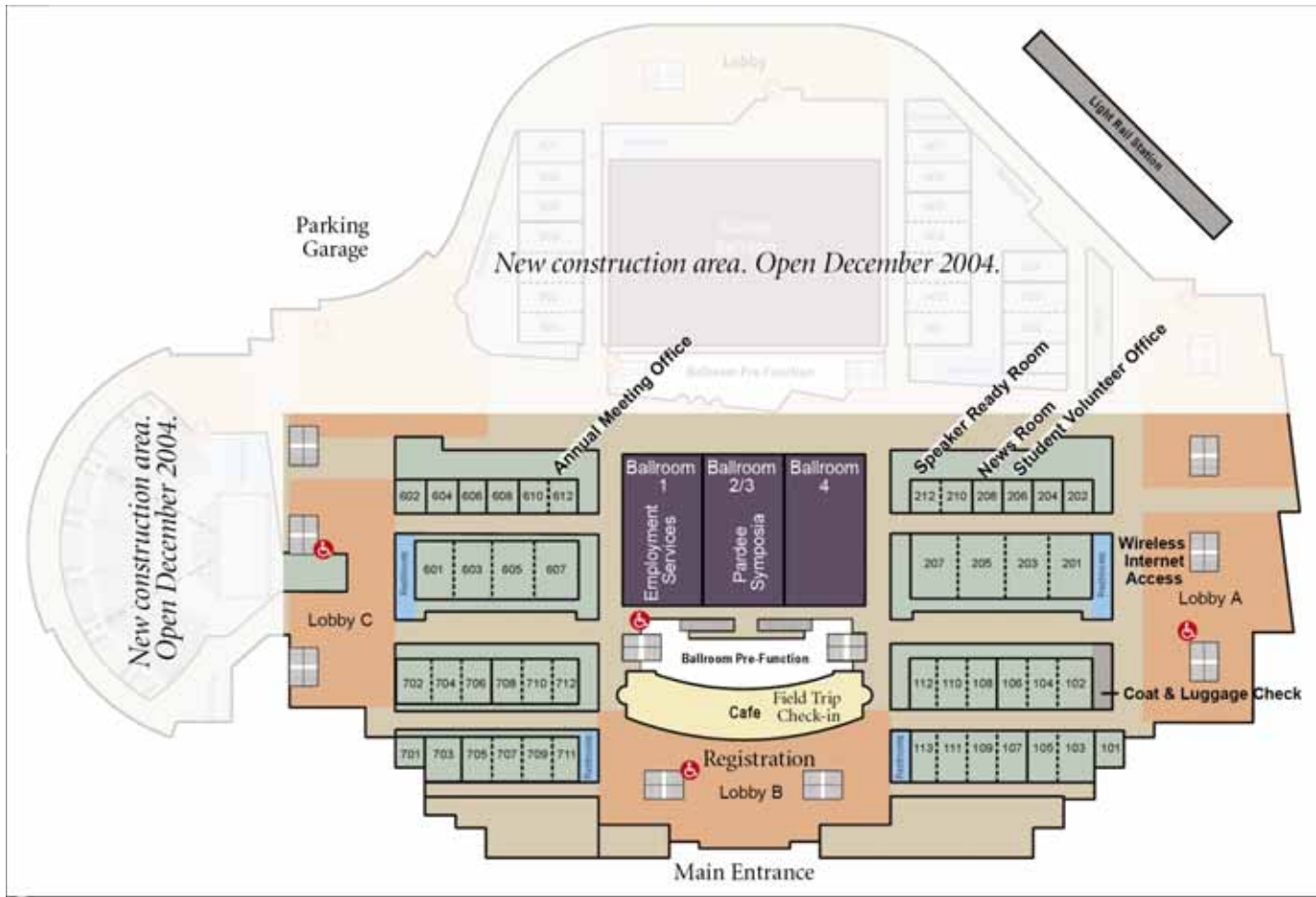
Denver Hotel & Street Map



DENVER HOTELS	RATES (single/double)	NO. ON MAP	DISTANCE TO COLORADO CONVENTION CENTER
Marriott City Center (Co-Headquarters Hotel)	\$152/\$165	1	4 blocks
Hyatt Regency (Co-Headquarters Hotel)	\$150/\$162	2	4 blocks
Adam's Mark	\$142/\$142	3	4 blocks
Brown Palace	Standard \$160/\$160 Superior \$180/\$180	4	5 blocks
Comfort Inn Downtown	SOLD OUT	5	5 blocks
Executive Tower	SOLD OUT	6	3 blocks
Holiday Inn Downtown	SOLD OUT	7	1.5 blocks
Westin Tabor Center	\$157/\$157	8	5 blocks

For more information and to view the hotels, go to the online Hotel Reservation Form at www.geosociety.org.

~ Convention Center Map ~



You Are Invited

To Meet the Authors and a Book Signing
 GSA Bookstore, Exhibit Hall—Just follow the crowd!
 Sun., Nov. 7, 5:30–7:30 p.m.

Visit the Members' Corner and Combined Publishers
 Display featuring books from a wide variety of publishers.

Earth Colors
Sarah Andrews

detachment fault
Susan Cummins Miller

EVIDENCE FROM THE EARTH
Raymond C. Murray

THE BIG ONE
Jake Page & Charles Officer

THE MAN WHO FOUND TIME
James Hutton

GORGON
Peter D. Ward

2004 Guest Authors:

- Sarah Andrews—*Earth Colors*
- Herb Meyer—*Fossils of Florissant*
- Susan Cummins Miller—*Detachment Fault*
- Ray Murray—*Evidence from the Earth*
- Jake Page—*The BIG One*
- Jack Repcheck—*The Man Who Found Time*
- Stan Riggs—*Drowning the North Carolina Coast*
- Daniel Sarewitz—*Living with the Genie: Essays on Technology and the Quest for Human Mastery*
- Peter D. Ward—*Gorgon*
- Jerry Wermund—*The World According to Rock*



HOT TOPICS

Colorado Convention Center
Room 705/707

Sun.–Wed., Nov. 7–10, 12:15–1:15 p.m.

Join your colleagues for spirited lunchtime discussions and debates on several burning issues for the professional geologic community. Chili and beer will be available for purchase outside the meeting room.

Sunday, November 7

1. Earth's Ice on the Rocks—The Meltdown of Permafrost, Ice Sheets, and Glaciers

The planet's permafrost, continental ice sheets, and glaciers are thawing at a historically unprecedented rate. A panel of experts will examine the causes, potential consequences, and how earth scientists are helping to understand the issues.

Monday, November 8

2. Feeling the Heat—The Fallout from the 1999–20?? Western United States Drought

Much of the western U.S. is feeling the impacts of a major drought that is currently in its fifth year. How long might the current drought last? What will its impact be on diverse western issues such as water supply, population growth, the economy, ecosystem health, and wildfire potential? A panel of scientists, policy makers, and other experts will help explore answers to these and other questions.

Tuesday, November 9

3. Fact or Fiction?

Earth Sciences in Popular Films and Literature
A number of movies and novels have highlighted earth processes and earth scientists, but some have been criticized for playing loose with the science facts in the interest of making the product more compelling to audiences. How can the earth science community work with moviemakers and writers to enhance the scientific accuracy of films and novels without diminishing their excitement? How can we best respond to inaccuracies? Invited panelists include earth scientists who have served as advisors to movie or fiction writers, earth science communications specialists, and earth scientists who have become successful popular writers.

Wednesday, November 10

4. Earth Sciences in Homeland Security

National and global events of the last several years have brought security concerns to the forefront of daily life in countries throughout the world. This hot topic will bring together experts in homeland security, science policy, and earth sciences (such as forensic geology) to discuss whether or not there are appropriate roles for earth scientists, their technologies, and their methodologies in helping to make societies more secure.

HOT TOPICS CHAIR:

Geoffrey S. Plumlee
U.S. Geological Survey
Crustal Imaging and Characterization Team

Pardee Keynote Symposia

The Pardee Keynote Symposia are special events of broad interest to the geoscience community. They represent topics on the leading edge in a scientific discipline or area of public policy, address broad fundamental issues, and are interdisciplinary. Selection was on a competitive basis. This year's eight Pardee Keynote Symposia were reviewed and accepted by the Annual Program Committee.

ALL SYMPOSIA WILL BE HELD IN THE COLORADO CONVENTION CENTER.

Medical Geology

Sun., Nov. 7, 8 a.m.–noon, Ballroom 2 & 3

Geoscientific Aspects of Human and Ecosystem Vulnerability

Sun., Nov. 7, 1:30 p.m.–5:30 p.m., Ballroom 2 & 3

Adversity, Advantages, Opportunities: Phanerozoic Stromatolites as "Survivor" vs. "Disaster" Taxa

Mon., Nov. 8, 8 a.m.–noon, Ballroom 2 & 3

Early Paleoproterozoic (2.5–2.0 Ga) Events and Rates: Bridging Field Studies and Models

Mon., Nov. 8, 1:30 p.m.–5:30 p.m., Ballroom 2 & 3

Geoinformatics and the Role of Cyberinfrastructure in Geosciences Research

Tues., Nov. 9, 8 a.m.–noon, Ballroom 2&3

Pre-Mesozoic Impacts: Their Effect on Ocean Geochemistry, Magnetic Polarity, Climate Change, and Organic Evolution

Tues., Nov. 9, 8 a.m.–noon, Ballroom 4

Weathering, Slopes, Climate, and Late-Quaternary Geomorphic Change in Arid and Semi-Arid Landscapes

Tues., Nov. 9, 1:30 p.m.–5:30 p.m., Ballroom 2 & 3

Seeing Mars with New Eyes: Active Missions, Science Results, and Geoscience Education

Wed., Nov. 10, 8 a.m.–noon, Ballroom 2 & 3

The Pardee Keynote Symposia are made possible by a grant from the Joseph T. Pardee Memorial Fund.

GSA's Inaugural Hall of Fame

As you are hustling between tech sessions, please be sure to take the time to peruse "Denver's 2004 Hall of Fame—Geoscientists Who are Changing the World." This meeting-long display honors GSA's current and past geoscience award winners, AGI's current and past recipients of the Medal in Memory of Ian Campbell, the GSA Divisions' current and past awardees, GSA Fellows and Honorary Fellows, GSA's 50-year members, and our Allied and Associated Society award recipients. Take a moment to acknowledge your colleagues, mentors, students—and maybe even yourselves—for all the hard work that went into this well-deserved recognition!



Recently Published GSA Special Papers

Sulfur Biogeochemistry—Past and Present

edited by Jan P. Amend, Katrina J. Edwards,
and Timothy W. Lyons, 2004

SPE379, 205 p., ISBN 0-8137-2379-5

\$75.00, member price \$60.00

Detrital Thermochronology—Provenance Analysis, Exhumation, and Landscape Evolution of Mountain Belts

edited by Matthias Bernet and Cornelia Spiegel, 2004

SPE378, 126 p., ISBN 0-8137-2378-7

\$55.00, member price \$44.00

Precambrian Geology of the Tobacco Root Mountains, Montana

edited by John B. Brady, H. Robert Burger, John T. Cheney,
and Tekla A. Harms, 2004

SPE377, 256 p., plate, ISBN 0-8137-2377-9

\$100.00, member price \$80.00

Posture, Locomotion, and Paleoeology of Pterosaurs

by Sankar Chatterjee and R.J. Templin, 2004

SPE376, 64 p., ISBN 0-8137-2376-0

\$50.00, member price \$40.00

Natural Hazards in El Salvador

edited by William I. Rose, Julian J. Bommer, Dina L. López,
Michael J. Carr, and Jon J. Major, 2004

SPE375, 480 p. plus index, ISBN 0-8137-2375-2

\$100.00, member price \$80.00

Tectonic Evolution of Northwestern México and the Southwestern USA

edited by Scott E. Johnson, Scott R. Paterson, John M. Fletcher,
Gary H. Girty, David L. Kimbrough, and Arturo Martín-Barajas,
2003

SPE374, 455 p. plus index, CD-ROM, ISBN 0-8137-2374-4

\$95.00, member price \$76.00

In Press

Gneiss Domes in Orogeny

edited by Donna L. Whitney,
Christian Teyssier, and
Christine S. Siddoway, 2004

SPE380, 378 p. plus index

ISBN 0-8137-2380-9



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Memoir

Proterozoic Tectonic Evolution of the Grenville Orogen in North America

edited by Richard P. Tollo,
Louise Corriveau, James M. McLelland,
and Mervin J. Bartholomew

MWR197, 798 p. plus index,

ISBN 0-8137-1197-5

\$195.00, member price \$156.00



ANNOUNCEMENTS

About People

GSA Fellow **Cahit Coruh**, professor of geosciences in the College of Science at Virginia Tech, was conferred with the title "professor emeritus" by the Virginia Tech Board of Visitors during the board's quarterly meeting Monday, August 23. A member of the Virginia Tech faculty since 1979, Coruh was a dedicated teacher and adviser to both undergraduate and graduate geophysics and geosciences students. Coruh served as the head of the Department of Geosciences from 1994 to 2004 and led the department to become one of the top-rated geosciences programs in the country.

At the first Ordinary Session of the merged International Union of Geological Sciences/International Geological Congress Council, held in Florence, Italy, in conjunction with the 32nd International Geological Congress, the following new officers were elected: Zhang Hongren, president; GSA member **Peter T. Bobrowsky**, secretary general; Antonio Brambati, treasurer; and GSA Fellow **Eldridge Moores** and Sylvi Haldorsen, vice presidents. GSA member **Ryo Matsumoto** was among the councilors elected. The next congress will be held in Oslo, Norway, in 2008.

GSA Fellow **David Piper** has been elected vice president of the Geological Association of Canada. Piper, a research scientist with the Geological Survey of Canada (Atlantic) at the Bedford Institute of Oceanography in Halifax, is an expert on deep-water marine sediments and is currently assigned to work on geohazards to hydrocarbon exploration and production in deep water off the East Coast of Canada. He is best known internationally for his work on deep-water turbidite systems, based on comparison of modern and ancient deposits.

GSA Member **Jim Ryan**, research scientist at the Geological Survey of Canada, was elected to a three-year term as Councilor of the Geological Association of Canada. Ryan's other volunteer activities include vice chair of the Geological Association of Canada's (GAC) Structural Geology and Tectonics Division, vice president of the GAC Cordilleran Section, and community advisor for the University of British Columbia GAC Student Chapter.

The Association of American State Geologists elected the following new leaders for the term of July 1, 2004, to June 30, 2005. GSA Fellow **Robert G. Marvinney**, Maine State Geologist, president; GSA Fellow **Peter A. Scholle**, New Mexico State Geologist, president-elect; GSA Member **Scott W. Tinker**, Texas State Geologist, vice president; GSA Fellow **Edmond G. Deal**, Montana State Geologist, secretary; and GSA Member **Berry H. (Nick) Tew Jr.**, Alabama State Geologist, treasurer. The AASG consists of the heads of geological surveys in each of the 50 states and Puerto Rico. Founded in 1908, the AASG seeks to advance the science and practical application of geology and related earth sciences in the United States and its territories, commonwealths, and possessions.

Your Support Needed for Forming GSA Geomedicine Division

*E. Lynn Savage, Brooklyn College, The City University
of New York*

The term "geomedicine," first used in the mid-1900s, is now defined as the influence of geofactors on causes and distribution of compromised health in both modern and ancient humans and animals. Growing concern about health problems linked to burgeoning effects of geofactors justifies the creation of a GSA Geomedicine Division. The division will be concerned with applications of medical geology, medical geography, environmental medicine, and other fields that address environmentally caused health problems.

To form the Geomedicine Division, we need the support of 100 GSA members and approval by GSA Council. To indicate your support, please write to geomed@geosociety.org. Petitions also will be available at the GSA Annual Meeting in Denver in November; please consult the meeting program for time and location of our organizational meeting. You may belong to multiple GSA divisions, and your participation may be active or passive.

MEETINGS CALENDAR

2005

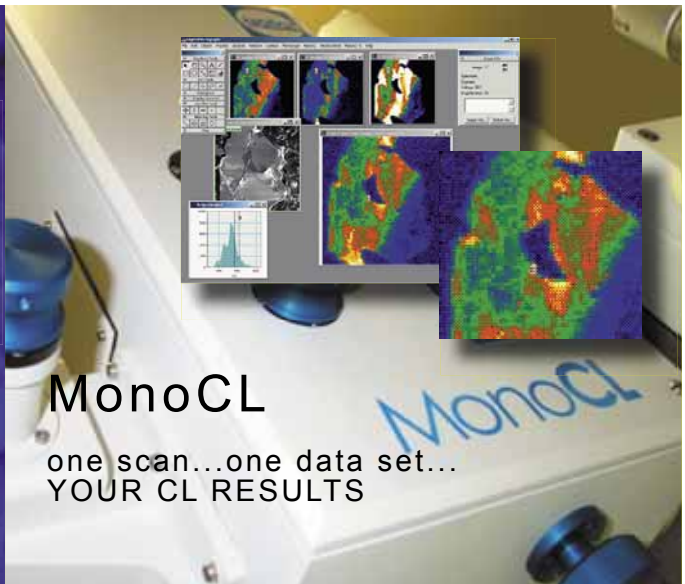
March 6-11 Geologic Problem Solving with Microfossils: An International Conference in Memory of Garry D. Jones, Houston, Texas, USA. **Information:** Thomas Demchuk, Thomas.D.Demchuk@conocophillips.com, www.sepm.org/microfossils2005.htm. (*Abstract deadline: October 14, 2004.*)

April 3-7 Symposium on the Application of Geophysics to Engineering and Environmental Problems (SAGEEP 2005), Atlanta, Georgia. **Information:** Environmental and Engineering Geophysical Society, 1720 South Bellaire Street, Suite 110, Denver, CO 80222-4303, USA, (303) 531-7517, fax 303-820-3844, staff@eegs.org, www.eegs.org.



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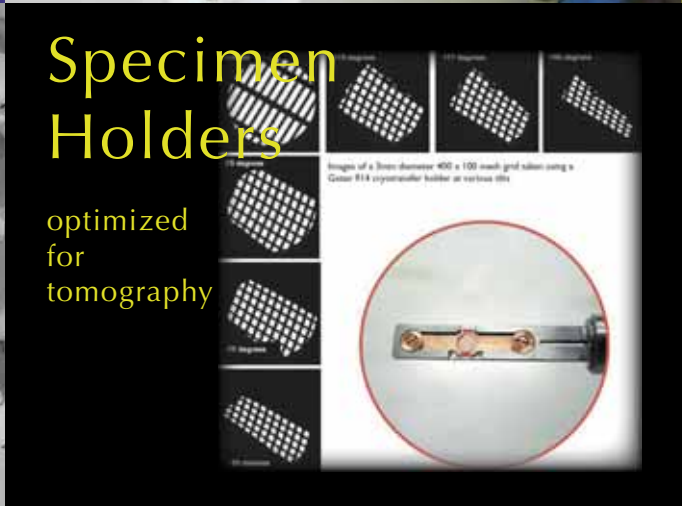
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JOINT MEETING

**39th Annual Meeting of the South-Central Section, GSA, Annual Spring Meeting, The Pander Society, and Annual Spring Meeting, Texas Section, Association of Engineering Geologists
Trinity University, San Antonio, Texas**

April 1–2, 2005

Trinity University is a private, predominantly undergraduate institution that offers degrees in more than 25 departments and programs. In 2003, the institution was ranked #1 among comprehensive universities in the West by *U.S. News and World Report* for the 12th consecutive year.

San Antonio, now the 8th largest city in the United States, has retained its sense of history and tradition while combining a multicultural heritage with cosmopolitan progress. The city is positioned within and south of the Balcones Fault Zone, which separates the Edwards Plateau (Texas “hill country”) and Gulf Coastal Plain.

TRAVEL AND TRANSPORTATION

Most major airlines serve the San Antonio International Airport. Trinity is centrally located, approximately 6 miles south of the airport and 3 miles north of the renowned downtown Riverwalk area. Many rental car agencies are located on or near the airport property.

Driving time from Houston (197 mi.) is about 3.3 hours; from Austin (79 mi.), 1.3 hours; and from Dallas (275 mi.), 4.5 hours.

NOTE: Shuttle service will *not* be provided between local hotels and the university campus. Parking will be available in the Alamo Stadium parking lot, conveniently located across the street from buildings where sessions will be held.

ACCOMMODATIONS

Tourism is a major industry in San Antonio and late March–early April is a very popular time for tourists. Meeting participants are responsible for making their own housing arrangements and are strongly encouraged to book their rooms as early as possible.

A block of rooms has been reserved at the Doubletree Inn (37 N.E. Loop 410). Rooms (singles or doubles) will cost \$89 per room per night plus taxes (16.75%). To obtain this rate, you must phone the hotel at 800-535-1980 or (210) 366-2424 and state that you are affiliated with Trinity University/GSA. The deadline for reserving rooms at this rate is March 1.

Other hotels close to Trinity (~10–15 minutes driving time) include:

Amerisuites—Airport, 7615 Jones Maltsberger, (210) 930-2333
Holiday Inn Select, 77 NE Loop 410, (210) 349-9900

Holiday Inn Express, 91 NE Loop 410, (210) 308-6700
Drury Inn & Suites, 95 NE Loop 410, (210) 308-8100

REGISTRATION

Standard Registration Deadline: February 28, 2005

Cancellation Deadline: March 7, 2005

GSA Headquarters will handle meeting registration. Registration will be available online at www.geosociety.org beginning December 2004. On-site registration will be available on the campus of Trinity University during the meeting. More details will be in the December 2004 issue of *GSA Today*. Standard registration fees for professional members and students will be approximately \$90 and \$35, respectively.

CALL FOR PAPERS

Abstract deadline: December 17, 2004

Papers are invited for symposia, theme sessions, and general sessions, in both oral and poster formats. Abstracts not included in symposia will be scheduled for theme or general session, as appropriate. All abstracts must be submitted online at www.geosociety.org. An abstract submission fee of \$10 will be charged. Only one volunteered paper may be presented by an individual; however, a person may be a co-author on other papers. Also, those invited for symposia may present other papers.

SYMPOSIA AND THEME SESSIONS

For more information, or to propose another symposium or theme session, contact Diane Smith, dsmith@trinity.edu, (210) 999-7656.

Symposia

1. **Mapping Active Surface Faults and Areas of Coastal Subsidence along the Northern Edge of the Gulf of Mexico: Technologies New and Old.** Robert Traylor, Rtraylor@tceq.state.tx.us, (512) 239-0520; Roy Dokka, rkdokka@c4g.lsu.edu, (225) 578-2975.
2. **Pander Society Conodont Symposium.** Lance Lambert, Llambert@utsa.edu, (210) 458-5447.

Theme Sessions

1. **Proterozoic Growth and Evolution of Southern Laurentia.** Calvin Barnes, cal.barnes@ttu.edu, (806) 742-3106; Melanie Barnes, Melanie.Barnes@ttu.edu, (806) 742-3204.
2. **Faulting and Related Deformation in the Balcones Fault System and Influence on the Edwards and Trinity Aquifers.** David A. Ferrill, dferrill@swri.edu; (210) 522-6082; Alan P. Morris, alanm52@flash.net.
3. **Geology of Bays, Estuaries, Barrier Islands, and Inner Shelf of the Northern Gulf of Mexico.** William Sager, wsager@ocean.tamu.edu, (979) 845-9828; Tim Dellapenna, dellapet@tamug.tamu.edu; (409) 749-4952.
4. **Undergraduate Research Poster Session.** Sponsored by the Council on Undergraduate Research, Geosciences Division. Wendi Williams, WJWILLIAMS@ualr.edu, (501) 569-3542.

5. **Professional Licensure and National Academic Accreditation: Opportunities and Constraints for Geology Practice in the Millennium.** Lou Gilpin, lgilpin@gilpingeosciences.com, (415) 383-8543; Melanie Barnes, Melanie.Barnes@ttu.edu, (806) 742-3204.

WORKSHOPS

Registration in workshops is free but space is limited.

1. **Geologic Issues and YOUR Legislators**, Thurs., March 31, in Austin. A workshop on the nuts and bolts of how to approach Congress and state legislatures about geologic public policy. Melanie Barnes, Melanie.Barnes@ttu.edu, (806) 742-3204.
2. **K-12 Earth Science Education and the National Science Education Standards**, Sat., April 2. This workshop will investigate earth science education and its relationship to the National Science Education Standards with emphasis on the recent activity in Texas. Edward C. Roy Jr., eroy@trinity.edu, (210) 999-7609.

FIELD TRIPS

Both premeeting and postmeeting field trips are planned. Registration for some trips is limited.

Premeeting

1. **Structure of the Balcones Fault System and Influence on the Edwards and Trinity Aquifers, South-Central Texas.** March 31 (1-day trip). David A. Ferrill, dferrill@swri.edu, (210) 522-6082; Alan P. Morris, alanm52@flash.net, (210) 458-5450; Deborah J. Waiting, dwaiting@swri.edu, (210) 522-5502.
2. **Volcanic Rocks of the Balcones Igneous Province.** March 31 (1-day trip). William R. Griffin, griffin@utdallas.edu, (972) 883-2401; Tom Ewing, tewing@satx.rr.com, (210) 493-1626; Matt Leybourne, mleybo@utdallas.edu, (972) 883-2403; Steve Bergman, bergman@utdallas.edu, (972) 883-4365.

Postmeeting

3. **Precambrian Geology of the Western and Central Llano Uplift, Texas.** April 3-4 (2-day trip). Mark Helper, helper@mail.utexas.edu, (512) 471-1009; Sharon Mosher, mosher@mail.utexas.edu, (512) 471-4135.
4. **Cambro-Ordovician of the Southern Llano Uplift Region, Central Texas: Conodont Biostratigraphy, Sequence Stratigraphy, and Biogeochemistry.** April 3 (1-day trip). James F. Miller, jfm845f@smsu.edu, (417) 836-5447.
5. **Geologic and Historical Bike Tour of the San Antonio River Watershed.** April 3 (half-day trip). Chris Beal, bealc@campstanley.net, (210) 336-1171.
6. **The San Antonio River: History, Hydraulics, and Urban Geology.** April 3 (1-day trip). Christopher C. Mathewson, mathewson@geo.tamu.edu, (979) 845-2488.
7. **Hydrogeology of Deep Phreatic Karst in Sistema Zacatón, Northeastern Mexico.** April 3-6. John M. Sharp Jr., jmsharp@mail.utexas.edu; (512) 471-3317; Marcus Gary, marcusgary@mail.utexas.edu, (512) 470-8029.

STUDENT ACTIVITIES

Roy J. Shlemon Mentor Program in Applied Geoscience. Sponsored by GSA Foundation. Fri., April 1, 11:30 a.m.-1 p.m. Karlon Blythe, kblythe@geosociety.org. Lunch provided. This interactive and informative program for undergraduate and graduate students, led by professional geoscientists, will cover real-life issues including professional opportunities and challenges that await students after graduation. Students will receive in their registration packet a FREE LUNCH ticket to attend the program; however, space is limited. First come, first served.

The John Mann Mentors in Applied Hydrogeology Program. Sponsored by GSA Foundation. Fri., April 1, 5-6:30 p.m. Karlon Blythe, kblythe@geosociety.org. Refreshments provided. This event presents mentoring opportunities for undergraduate and graduate students and recent graduates with declared interest in hydrogeology as a career to interact and network with practicing hydrogeology professionals. The focused, small-scale program features FREE FOOD for participants. Participant eligibility is limited to those students who have declared their career interest to be hydrology or hydrogeology on their GSA membership applications and who have registered online for this meeting. An e-mail invitation will then be sent to those qualified students. Only a quick response to the invitation will secure you a seat, as attendance is limited!

STUDENT SUPPORT

Travel grants are available from the South-Central Section in cooperation with the GSA Foundation for GSA Student Associates who are presenting oral or poster papers. Students must be currently enrolled as GSA members to be eligible. Please visit www.geosociety.org, South-Central Section, for details regarding application instructions. For more information, contact Elizabeth Y. Anthony, eanthony@geo.utep.edu.

SOCIAL ACTIVITIES

Welcoming Party. Thurs., March 31, 5-7 p.m., 151 Oakmont Court, Trinity University campus. A shuttle bus will make trips between the Doubletree Hotel and the residence between 4:45 and 7 p.m.

Deli Lunch. Fri., April 1 (time and location TBA). Provided for all meeting registrants.

Banquet. Fri., April 1, 6 p.m., Great Hall, Chapman Graduate Center. Ticketed event with limited seating. Keynote speaker: Scott W. Tinker, Director of the Bureau of Economic Geology.

Mexican Buffet Lunch. Sat., April 2, Skyline Room, Coates University Center. Ticketed event with limited seating.

BUSINESS MEETINGS

South-Central Section Management Board Meeting. Fri., April 1, 4 p.m., location TBA.

South-Central Section GSA Business Meeting. Fri., April 1, 5:30 p.m., Great Hall, Chapman Graduate Center.

Texas Section AEG Business Meeting. Time and place TBA.

CONTACT INFORMATION

GSA is committed to making all events at the 2005 meeting accessible to all people interested in attending. Special requirements (wheelchair accessibility, dietary concerns, etc.) can be indicated on the registration form. If you have any additional questions, contact the Local Organizing Committee Chair, Diane Smith, dsmith@trinity.edu, (210) 999-7656.

JOINT MEETING

**101st Annual Meeting of the Cordilleran Section,
GSA, and 80th Annual Meeting of the Pacific
Section, AAPG
Fairmont Hotel, San José, California**

April 29–May 1, 2005

THEME: BAY, BASINS, BASEMENT, AND BEYOND

The 2005 annual meetings of the Cordilleran Section, GSA and the Pacific Section, American Association of Petroleum Geologists, will be held jointly at the Fairmont Hotel in San José, hosted by the Department of Geology, San José State University. Up-to-date information about the meeting can be found at www.geosociety.org/sectdiv/sections.htm.

ENVIRONMENT

The city of San José is located at the southern tip of San Francisco Bay and is the 3rd largest city in California and 11th largest in the United States. San José is nestled in a broad alluvial valley between the Santa Cruz Mountains to the west and the Diablo Range to the east. Longtime residents still refer to the San José area as the “Valley of Heart’s Delight,” hearkening back to its agricultural roots and gentle climate, but it is widely known today as “Silicon Valley,” where technology and innovation rule. San José is among the most ethnically diverse cities in North America, and one can find a rich tapestry of cultural sites and activities to explore and experience. Temperatures are mild in late April and early May (60–70 °F), and the area has tremendous recreational opportunities for all to enjoy. San José is served by most major airlines through Mineta–San José International Airport, just 3 miles from downtown. The meeting site is the spectacular Fairmont Hotel in the heart of downtown San José and adjacent to Plaza de Cesar Chavez. The Fairmont is on the VTA light rail line and is within easy walking distance to many restaurants, pubs, microbreweries, clubs, cinemas, galleries, and museums.

CALL FOR PAPERS

Papers are invited for a variety of sessions (oral and poster), including symposia, theme sessions, and general technical sessions. Authors interested in volunteering papers for symposia should contact the appropriate convener prior to submitting an abstract. Oral presentations in most technical sessions will be 15 minutes in length, including three minutes for questions. Some sessions may be organized with a longer format. Contact session chairs for details. All oral sessions will utilize a single digital projector and PowerPoint software. An overhead projector will also be available in each room. Use of 35 mm slides is discouraged and will only be accommodated by special arrangement with the technical program chair at an additional cost. Requests for slide projectors must be made one month

prior to the meeting. Poster space will be 4 by 8 feet, and authors will be required to be present at their poster for at least two hours.

ABSTRACTS

Abstract deadline: February 1, 2005

Abstracts for all sessions should be submitted online at www.geosociety.org. If you cannot submit your abstract electronically, contact Nancy Carlson, (303) 357-1061. An abstract submission fee of \$10 will be charged. Only one volunteered paper may be presented by an individual; however, a person may be a co-author on other papers. Those invited for symposia may present an additional paper.

REGISTRATION

Standard Registration Deadline: March 28, 2005

Cancellation Deadline: April 4, 2005

GSA Headquarters will handle meeting registration. Registration will be available online at www.geosociety.org beginning in January 2005. On-site registration will be available at the Fairmont Hotel during the meeting. More details will be in the January 2005 issue of *GSA Today*.

ACCESSIBILITY

GSA is committed to making its meetings accessible to all people interested in attending. Please indicate special requirements (wheelchair accessibility, etc.) on the registration form. The Fairmont Hotel is ADA compliant.

FIELD TRIPS

For descriptions of the following field trips, see www.geosociety.org/sectdiv/sections.htm; for further details, please contact either the trip leader or the field trip chair, Calvin Stevens, (408) 925-5029, stevens@geosun.sjsu.edu.

Premeeting

- 1. Seismic Hazard of the Front Range Thrust Faults, Santa Cruz Mountains.** 1 day, April 26. Drew Kennedy, Sanders & Associates, Geostructural Engineering, Inc., dKennedy@sandersgeo.com, (916) 729-8050; Chris Hitchcock, hitch@lettis.com.
- 2. Neoproterozoic Paleogeography of Southern Death Valley: Adding Some New Pieces to an Old Puzzle.** 3 days, April 26–28. Matt McMackin, San José State University, mcmackin@geosun.sjsu.edu, (408) 206-9521; Bennie Troxel, Lauren Wright, and Martin Kennedy, martin.kennedy@exxon-sprint.com.
- 3. Point Lobos to Point Reyes: Evidence of ~180 km Offset of the San Gregorio and Northern San Andreas Faults.** 2 days, April 27–28. Kathleen Burnham, Stanford University, katb@pangea.Stanford.edu, (510) 428-0464; Jean Moran, jeanm@stetsonengineers.com.
- 4. Jurassic–Cretaceous Assembly of Central California.** 2 days, April 27–28. Russell Graymer, U.S. Geological Survey, rgraymer@usgs.gov, (650) 329-4988.
- 5. Geology of Mount Diablo.** 1 day, April 28. Ron Crane, Consultant, roncrane@aol.com, (925) 837-6508.

6. **An Extensive Paleocene Cold Seep System: Clastic Dikes, Carbonates, and Chemosynthetic Communities in the Moreno Formation, Panoche Hills, Western San Joaquin Valley.** 1 day, April 28. Hilde Schwartz, hschwartz@emerald.ucsc.edu, (831) 459-5429, and Casey Moore, cmoore@es.ucsc.edu, both at University of California at Santa Cruz; James Sample, Northern Arizona University, James.Sample@nau.edu, (928) 523-0881.
7. **The Dirt on Wine, Geology, Soils, and Wine Quality in the Santa Clara Valley.** 1 day, TBA. Terry Wright, California State University, Sonoma, wrightw@sonoma.edu, (707) 479-0884. (*Must be 21 to attend.*)
8. **Microbialite Sediments in Death Valley.** 3 days, April 26–28. Thomas Anderson, California State University, Sonoma, andersot@sonoma.edu, (707) 664-2334; Russell Shapiro, rshapiro@gustavus.edu; Melissa Hicks, hickssm@unlv.nevada.edu.

Postmeeting

9. **Miocene Volcano-Plutonic Systems, Southern Nevada: A Window into Upper Crustal Magmatic Processes.** 3 days, May 2–4. Calvin Miller, Vanderbilt University, calvin.miller@vanderbilt.edu, (615) 322-2976; Jonathan Miller, San José State University, jsmiller@email.sjsu.edu; Jim Faulds, jfaulds@unc.edu.
10. **Late Neogene Transition from Transform to Subduction Margin East of the San Andreas Fault, Petaluma to Willits, California.** 3 days, May 2–4. Bob McLaughlin, U.S. Geological Survey, rjmcl@usgs.gov, (650) 329-4945; Dave Wagner, California Geological Survey, dwagner@consv.gov; Harvey Kelsey, hmkl@humboldt.edu.
11. **Large Dextral Offset Across Owens Valley, California, from 148 Ma to 1872 A.D.** 3 days, May 2–4. Allen Glazner, University of North Carolina, afglazne@email.unc.edu, (919) 962-0689; Jeffrey Lee, jeff@geology.cwu.edu; John Bartley, jbartley@mines.utah.edu; David Greene, GreeneD@denison.edu; Drew Coleman, dcoleman@unc.edu; Andrew Kylander-Clark, akylander@umail.ucsb.edu.
12. **Outcrop Geology of Some Cretaceous and Tertiary Gas-Producing Strata of the Sacramento Basin.** 3 days, May 1–3 (leaves after meeting ends). Douglas Imperato, Consulting Geologist, dpi@gte.net, (805) 963-2399; Tor Nilsen, nilsen@pacbell.net.
13. **The Miocene Hydrocarbon Migration System: Clastic Intrusions and Carbonate Seep Structures in the Santa Cruz Area, California.** 1 day, May 2. Robert Garrison, regarris@cats.ucsc.edu, (831) 423-4401, and Casey Moore, casey@es.ucsc.edu, both at University of California at Santa Cruz; Ivano Aiello, iaiello@mlml.calstate.edu.
14. **San Francisco Bay: Floating Classroom on an Urban Estuary.** 1 day, May 2. Matt McMackin, San José State University, mcmackin@geosun.sjsu.edu, (408) 206-9521.
15. **Franciscan Complex and Coast Range Ophiolite, Eastern San Francisco Bay Area: A Record of Processes along a Complex Active Plate Margin.** 1 day, May 2. John Wakabayashi, Geologic Consultant, wako@tdl.com, (510) 887-1796.

TECHNICAL SESSIONS

In addition to general technical sessions, the program will include a variety of symposia and theme sessions. Detailed description of symposia and theme sessions can be found at www.geosociety.org/sectdiv/sections.htm.

Symposia

1. **Alaskan Energy Resources: New Assessments and Related Geological, Geophysical, and Geochemical Studies.** Rick Stanley, rstanley@usgs.gov, (650) 329-4918; Ken Bird, kbird@usgs.gov, (650) 329-4907, U.S. Geological Survey, 345 Middlefield Road, M/S 969, Menlo Park, CA 94025.
2. **Tectonics of the U.S. Cordillera, SWEAT Connection and Beyond: A Session in Honor of Eldridge Moores.** *Sponsored by GSA Cordilleran Section.* Yildirim Dilek, Miami University, Department of Geology, Shideler Hall, Oxford, OH 45056, dileky@muohio.edu, (513) 529-2212; John Wakabayashi, wako@tdl.com, (510) 887-1796.
3. **Crowding the Rim—Dealing with Energy Needs, Food, and Other Living Resources and Natural Calamities around the Pacific.** *Sponsored by the Circum Pacific Council.* David G. Howell, U.S. Geological Survey, Menlo Park, CA 94025, dhowell@usgs.gov, (650) 329-5430; H. Gary Greene, Moss Landing Marine Laboratories, Moss Landing, CA 95039, greene@mlml.calstate.edu, (831) 771-4183; Nahum Schneidermann, Chevron Texaco Overseas Petroleum, Inc., P.O. Box 5046, San Ramon, NAHU@chevrontexaco.com, (925) 842-3679.
4. **Ophiolites, Batholiths, and Regional Geology: A Session in Honor of Cliff Hopson.** Jim Wright, University of Georgia, jwright@gly.uga.edu, (706) 542-4394.
5. **Plutons and Their Host Rocks in the Sierra Nevada Batholith: A Forum and Discussion on Magma Emplacement, Magmatic Differentiation, and Pluton Solidification.** Drew Coleman, University of North Carolina, dcoleman@unc.edu, (919) 962-0705; William Hirt, College of the Siskiyous, hirt@siskiyous.edu; Aaron Yoshinobu, Texas Tech University, aaron.yoshinobu@ttu.edu.

Theme Sessions

Cordilleran Section, GSA

1. **Provenance of Sediments and Sedimentary Rocks in the Cordillera.** Andrew Barth, Department of Geology, Indiana University–Purdue University, Indianapolis, IN 46202-5132 USA, ibsz100@iupui.edu, (317) 274-1243; Nancy Riggs, Department of Geology, Northern Arizona University, Flagstaff, AZ 86011, nancy.riggs@nau.edu, (928) 523-4561.
2. **Late Cenozoic Transition from Subduction to Transform Margin Inboard of the San Andreas Fault: Northern San Francisco Bay Area to Cape Mendocino.** Robert J. McLaughlin, U.S. Geological Survey, rjmcl@usgs.gov, (650) 329-4945; David L. Wagner, California Geological Survey, dwagner@consv.gov.
3. **Earthquakes, Past and Future, in the San Francisco Bay Region.** David P. Schwartz, U.S. Geological Survey, dschwartz@usgs.gov, (650) 329-5651; William Lettis,

William Lettis & Associates, lettis@lettis.com, (925) 256-6070.

4. **Transpressional Neotectonics of the Central and Northern California Coast Ranges.** Jeff Unruh, William Lettis & Associates, Inc., 1777 Botelho Drive, Suite 262, Walnut Creek, CA 94596, unruh@lettis.com, (925) 256-6070.
5. **Crustal cross sections from the western North America Cordillera and Elsewhere—Implications for Tectonic and Petrologic Processes.** Art Snoke, University of Wyoming, snoke@uwyo.edu (307) 766-5457.
6. **Hydrogeology of Alluvial Aquifers in the Western U.S.** June Oberdorfer, San José State University, june@geosun.sjsu.edu, (408) 924-5026.
7. **Recent Advances in the Science of Floodplain and Channel Processes and Restoration.** Douglas Smith, Watershed Institute/Div. of Science and Environmental Policy, California State University Monterey Bay, Seaside, CA 93955, (831) 582-4696, Douglas_smith@csumb.edu; Joan Florsheim, Geology Department, University of California, Davis, CA 95616, florsheim@geology.ucdavis.edu.
8. **Naturally Occurring Asbestos Hazards: Geology, Regulatory Issues, and Methods of Identification and Assessment.** Mark Bailey, mbailey.asb@aol.com.
9. **Ethics in the Geological Community.** John Williams, San José State University, williams@geosun.sjsu.edu, (408) 924-5050.
10. **Earth Science for Everyone: Diverse Student Populations—Recruiting Techniques for Attracting Them, Curricular and Extracurricular Strategies for Retaining Them.** Ellen Metzger, metzger@geosun.sjsu.edu, (408) 924-5048, and Richard Sedlock, sedlock@geosun.sjsu.edu, (408) 924-5020, both at San José State University.
11. **Undergraduate Research Posters.** Karen Grove, Dept. of Geosciences, San Francisco State University, San Francisco, CA 94132, kgrove@sfsu.edu, (415) 338-2617.

Pacific Section, AAPG

12. **Sacramento Valley Gas Exploration and Production.** Rick Blake, Lawrence Livermore National Laboratory, Livermore, CA 94550, blake2@llnl.gov, (925) 422-9910.
13. **Application of New Technologies to Petroleum Reservoirs: Implications for Exploration.** Tim McHargue, TimMcHargue@chevrontexaco.com, (925) 842-6255, and Bryan Bracken, BryanBracken@chevrontexaco.com (925) 842-2144, both at ChevronTexaco, San Ramon, CA 94583.
14. **Application of New Technologies to Petroleum Reservoirs: Implications for Production.** Bryan Bracken, BryanBracken@chevrontexaco.com (925) 842-2144, and Tim McHargue, TimMcHargue@chevrontexaco.com (925) 842-6255, both at ChevronTexaco, San Ramon, CA 94583.
15. **CO₂ Sequestration: Science and Opportunity in the West.** S. Julio Friedmann, Lawrence Livermore National Laboratory; Livermore, CA 94550-9234; friedmann2@llnl.gov; (925) 423-0585

16. **A New Three-Dimensional Look at the Geology, Geophysics, and Hydrology of the Santa Clara Valley, California: A Showcase of Urban Earth Science.** Randall T. Hanson, U.S. Geological Survey, San Diego, CA 92123, rhanson@usgs.gov, (858) 637-6839; Bob Jachens, U.S. Geological Survey, Menlo Park, CA 94025, jachens@usgs.gov, (650) 329-5300.
17. **Data Visualization, 3-D Mapping, and Property Modeling.** Vic Madrid, Lawrence Livermore National Laboratory, Livermore, CA 94550, madrid2@llnl.gov, (925) 422-9930.
18. **Groundwater and Surface Water Interactions: Hydrogeology and Water Quality in the San Francisco Bay Region.** Alec Naugle, San Francisco Bay Regional Water Quality Control Board, Oakland, CA 94612, awn@rb2.swrcb.ca.gov, (510) 622-2510.

Pacific Section, SEPM

19. **Estimating Recharge.** Karin A. Hoover, Department of Geological and Environmental Sciences, California State University, Chico, CA 95929-0205, khoover@csuchico.edu, (530) 898-5618.
20. **Sediment Delivery to Streams: Mechanisms, Volumes, and Timing.** Karin A. Hoover, Department of Geological and Environmental Sciences, California State University, Chico, CA 95929-0205, khoover@csuchico.edu, (530) 898-5618.
21. **The Hydrobiogeochemical Cycle of Mercury.** William M. Murphy, Department of Geological and Environmental Sciences, California State University, Chico, CA 95929-0205, wmurphy@csuchico.edu, (530) 898-5163; Ronald K. Churchill, California Geological Survey, rchurch@consrv.ca.gov, (916) 327-0745.
22. **Tectonics and Sedimentation: New Models and Recent Advances.** Dave Barbeau, Department of Geological Sciences, University of South Carolina, Columbia, SC 29208, dbarbeau@geol.sc.edu, (803) 777-5162; Andrew L. Leier, University of Arizona, aleier@geo.arizona.edu.
23. **Beds to Basins in Turbidite Systems.** Stephan A. Graham, (650) 723-0507, graham@pangea.stanford.edu, and Donald R. Lowe, (650) 725-3040, lowe@pangea.stanford.edu, both at Department of Geological and Environmental Sciences, Stanford University, Stanford, CA 94305.
24. **Volcaniclastic Strata: Process, Paleogeography, and Tectonic Reconstructions.** Cathy Busby, Department of Geological Sciences, University of California, Santa Barbara, CA 93106, busby@geol.ucsb.edu, (805) 893-3471; Ian Skilling, Department of Geology and Planetary Sciences, 200 SRCC Building, University of Pittsburgh, Pittsburgh, PA 15260, skilling@pitt.edu, (412) 624-5873.
25. **Fault-Related Diagenesis and Fluid Flow.** Hilario Camacho, Signal Hill Petroleum, Long Beach, CA 90806, camachoh@shpi.net, (562) 595-6440; Jim Sample, Department of Geology, PO Box 4099, Northern Arizona University, Flagstaff, AZ, 86011, James.Sample@nau.edu, (928) 523-0881.

WORKSHOPS

Roy J. Shlemon Mentor Program in Applied Geoscience. Sponsored by GSA Foundation. Fri., April 29, and Sat., April 30, 11:30 a.m.–1 p.m. Lunch provided. Luncheon location available at GSA's registration desk. Karlon Blythe, kblythe@geosociety.org. This interactive and informative program for undergraduate and graduate students, led by professional geoscientists, will cover real-life issues, including professional opportunities and challenges that await students after graduation. Plan to attend both free luncheons to hear different presenters each day. Students will receive in their registration packet FREE LUNCH tickets to attend both Shlemon Programs; however, space is limited. First come, first served.

The John Mann Mentors in Applied Hydrogeology Program. Sponsored by GSA Foundation. Fri., April 29, 5–6:30 p.m. Refreshments provided. Location available at GSA's registration desk. Karlon Blythe, kblythe@geosociety.org. This event presents mentoring opportunities for undergraduate and graduate students and recent graduates with declared interest in hydrogeology as a career to interact and network with practicing hydrogeology professionals. The focused, small-scale program features FREE FOOD for participants. Participant eligibility is limited to those students who have declared their career interest to be hydrology or hydrogeology on their GSA membership applications and who have registered online for this Section meeting. An e-mail invitation will then be sent to those qualified students. Only a quick response to the invitation will secure you a seat, as attendance is limited!

SHORT COURSES

- Groundwater Age-Dating: Application and Interpretation of Tritium and the Noble Gases for Water Resource Investigations.** G. Bryant Hudson, hudson5@llnl.gov, (925) 422-3160; Jean E. Moran, moran10@llnl.gov, (925) 423-1478; and Andrew F. Tompson, tompson1@llnl.gov, (925) 422-6348, all at Lawrence Livermore National Laboratory.
- Application of Sequence Stratigraphy to Define the Aquifer Architecture of Groundwater Resources.** Morgan Sullivan, Department of Geosciences, California State University, Chico, CA 95929-0205, mdsullivan@csuchico.edu, (530) 898-4748; Kenneth Ehman, Skyline Ridge, Inc., Los Gatos, CA 95031-0150, kdehman@aol.com, (408) 482-0715; Brian Edwards, U.S. Geological Survey, Menlo Park, CA 94025, bedwards@usgs.gov, (650) 329-5488.
- Quantitative P-T-t Paths from Integrated Thermodynamic Modeling, Geochronology, and Metamorphic Textures.** Harold Stowell, Department of Geological Sciences, University of Alabama, Box 970338, Tuscaloosa, AL 35487-0338; hstowell@wgs.geo.ua.edu, (205) 348-5098; Douglas Tinkham, University of Calgary, tinkham@calgary.ca; Carlos Zuluaga, University of Alabama, zulua001@bama.ua.edu.
- Half-Day Bay Area Earth Science Institute (BAESI) Teacher Workshop.** Ellen Metzger, metzger@geosun.sjsu.edu, (408) 924-5048, and Richard Sedlock, sedlock@geosun.sjsu.edu, (408) 924-5020, both at San José State University.

SPECIAL EVENTS

Icebreaker. Thurs., April 28, Fairmont Hotel.
Keynote Address. Mary Lou Zoback, U.S. Geological Survey, zoback@usgs.gov.

An Evening of Exploration—Geology and Wine. Hosted by David Howell, U.S. Geological Survey, dhowell@usgs.gov; and Jonathan Swinchatt, authors of *The Winemakers Dance, Exploring Terroir in the Napa Valley*.

Annual Business Meeting. Cordilleran Section, GSA. TBA.
Annual Banquet and Business Meeting. Pacific Section, AAPG. TBA.

SPOUSE AND GUEST ACTIVITIES

The San José area offers a variety of activities, including a science center and IMAX theatre, a haunted house, one of the few combined public-university libraries, shopping, hiking, fine dining, and many more activities. For information on these and other activities, contact Paula Jefferis, San José State University, jefferis@geosun.sjsu.edu.

STUDENT TRAVEL

The Cordilleran Section, GSA, and the GSA Foundation have made travel grants available for students who are presenting oral or poster papers. Students must be currently enrolled and must be members of the relevant section to apply for support. For more information, contact the Cordilleran Section secretary, Joan Fryxell, (909) 880-5311.

STUDENT AWARDS

Awards will be given for best student oral (undergraduate or graduate) and poster (undergraduate only) presentations. To be eligible, students must be lead authors and presenters, and they should clearly identify their abstracts as student work.

EXHIBITS

Exhibit booths will be available for commercial organizations and nonprofit organizations. For more information or to reserve a booth, contact Larry Knauer, (661) 392-2471, larryknauer@chevrontexaco.com.

ACCOMMODATIONS

250 rooms have been reserved at the Fairmont Hotel, meeting headquarters. Special GSA rates are available. Information about making reservations via the housing bureau (strongly encouraged) will appear in the January 2005 *GSA Today*.

ADDITIONAL INFORMATION

To obtain the most complete and up-to-date information, visit www.geosociety.org/sectdiv/sections.htm. If you have additional questions or need further clarification, contact either of the convention co-chairs: Jonathan Miller, Cordilleran Section, GSA, jsmiller@email.sjsu.edu, (408) 924-5015, or Mel Erskine, Pacific Section, AAPG, mcerskine@comcast.net, (510) 234-6214.

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ATTENTION STUDENTS!

When you make your plans to attend your Section's 2005 meeting, be sure to include the Shlemon Mentor Program in your schedule. If you have career questions, we have the answers. You will have opportunities to chat one-on-one with practicing geoscientists over **FREE LUNCH**. All Sections will feature the Shlemon Mentor Programs in their proceedings.

Call for Geological Papers: 2005 GSA Section Meetings

Northeastern Section

March 14–16, 2005

Prime Hotel and Conference Center, Saratoga Springs, New York

Abstract Deadline: December 14, 2004

Information: Kurt Hollocher, Union College, Department of Geology, Olin Building, Nott Street, Schenectady, NY 12308-3107, (518) 388-6518, hollochk@union.edu

Southeastern Section

March 17–18, 2005

Grand Casino Biloxi, Biloxi, Mississippi

Abstract Deadline: December 14, 2004

Information: Gail Russell, University of Southern Mississippi, Department of Geology, Box 5044, Hattiesburg, MS 39406-2000, (601) 266-4077, Gail.Russell@usm.edu

South-Central Section

April 1–2, 2005

Trinity University, San Antonio, Texas

Abstract Deadline: December 17, 2004

Information: Diane Smith, Trinity University, Department of Geosciences, #45, One Trinity Place, San Antonio, TX 78212-4674, (210) 999-7656, dsmith@trinity.edu

Cordilleran Section

(Joint meeting with American Association of Petroleum Geologists)

April 29–May 1, 2005

Fairmont Hotel, San José, California

Abstract Deadline: February 1, 2005

Information: Jonathan Miller, San José State University, Department of Geology, 1 Washington Square, San José, CA 95192-0102, (408) 924-5015, jsmiller@email.sjsu.edu

North-Central Section

May 19–20, 2005

University of Minnesota, Minneapolis, Minnesota

Abstract Deadline: February 22, 2005

Information: Carrie Jennings Patterson, University of Minnesota, Minnesota Geological Survey, 2642 University Ave. W., St. Paul, MN 55114-1032, (612) 627-4780, ext. 220, carrie@umn.edu, or Barbara Lusardi, University of Minnesota, Minnesota Geological Survey, 2642 University Ave. W., St. Paul, MN 55114-1032, (612) 627-4780, ext. 212, lusar001@umn.edu

Rocky Mountain Section

May 23–25, 2005

Mesa State College, Grand Junction, Colorado

Abstract Deadline: February 22, 2005

Information: Rex Cole, Mesa State College, Department of Physical & Environmental Science, 1100 North Ave., Grand Junction, CO 81501-3122, (970) 248-1599, rcole@mesastate.edu

www.geosociety.org/sectdiv/sections.htm

Call for Nominations

2005 GSA Awards and Medals

Penrose Medal

The Penrose Medal was established in 1927 by R.A.F. Penrose Jr., to be awarded in recognition of eminent research in pure geology, for outstanding original contributions, or for achievements that mark a major advance in the science of geology. The award is made only at the discretion of the GSA Council; nominees may or may not be members of the Society. Penrose's sole objective in making the gift was to encourage original work in purely scientific geology, which is interpreted as applying to all scientific disciplines represented by the Society. Scientific achievements should be considered rather than contributions in teaching, administration, or service. Mid-career scientists who have already made exceptional contributions should be given full consideration for the award.

Day Medal

The Day Medal was established in 1948 by Arthur L. Day to be awarded annually, or less frequently, at the discretion of GSA Council, for outstanding distinction in contributing to geologic knowledge through the application of physics and chemistry to the solution of geologic problems. Day's intent was to recognize outstanding achievement and inspire further effort rather than reward a distinguished career. Scientific achievements should be considered rather than contributions in teaching, administration, or service.

Honorary Fellows

The GSA Council established Honorary Fellowship in 1909, and since then, except during a few war years, one or more Honorary Fellows have been elected annually. At present there are 67 living geologists who have received this honor.

Honorary Fellowship may be bestowed on individuals who have lived and developed their careers outside of North America and who have made outstanding and internationally recognized contributions to our science, or in rare cir-

cumstances, provided notable service to the Society. Under exceptional circumstances, North Americans have been named Honorary Fellows. This amendment to the bylaws was made in 1969 when the Apollo II astronauts who first walked on the Moon were elected.

The GSA Council encourages members to submit names of qualified candidates for this honor. In preparing a nomination, it is imperative that the original research and scientific advances of the candidate be stressed. The nominator should also verify all supporting data, especially degrees received, publications, positions held, etc.

How to Nominate (Penrose, Day, Honorary Fellows)

To ensure thorough consideration by the respective committees, please follow these instructions carefully: submit for each candidate a nomination form, a brief biographical sketch, such as used in *American Men and Women of Science* and *Who's Who in America*, a **summary** (200 words or less) of the candidate's scientific contributions to geology that qualify the individual for the award, and a **selected** bibliography of no more than 20 titles. Additional information supplied will not enhance the nomination.

A nomination for any one of these three awards must be supported by signed letters from each of five (5) GSA Fellows or Members **in addition** to the person making the nomination. The letters may be attached to the nomination form or may be sent to GSA separately. The names of unsuccessful candidates proposed to the Council by the respective committees will remain for consideration by those committees for three years. For those still under consideration, it is recommended that an updated nomination letter be sent to GSA.

The nomination form and instructions are available on the GSA Web site at www.geosociety.org under Grants, Awards & Medals. A nomination form may also be obtained from the Program Officer, Grants, Awards, and Recognition, (303) 357-1028, awards@geosociety.org. **The deadline for receipt of nominations is February 1, 2005.**

Young Scientist Award (Donath Medal)

The Young Scientist Award was established in 1988 to be awarded to a young scientist (35 or younger during the year in which the award is to be presented) for outstanding achievement in contributing to geologic knowledge through original research that marks a major advance in the earth sciences. The award, consisting of a gold medal (the Donath Medal) and a cash prize of \$20,000, was endowed by Dr. and Mrs. Fred A. Donath.

For the year 2005, only those candidates born on or after January 1, 1970, are eligible for consideration. In choosing candidates for the Young Scientist Award, scientific achievement and age will be the sole criteria. Nominations for the 2005 award must include:

- ▲ nomination form;
- ▲ biographical information;
- ▲ a **summary** of the candidate's scientific contributions to geology (200 words or less);
- ▲ a **selected** bibliography (no more than 10 titles); and
- ▲ supporting letters from five scientists **in addition** to the person making the nomination.

The nomination form and instructions are available at www.geosociety.org under Grants, Awards & Medals. A nomination form may also be obtained from the Program Officer, Grants, Awards, and Recognition, (303) 357-1028, awards@geosociety.org. **The deadline for receipt of nominations is February 1, 2005.**

Call for Nominations

2005 GSA Awards and Medals

GSA Public Service Award

GSA Council established the GSA Public Service Award in honor of Eugene and Carolyn Shoemaker in 1998 to be awarded for contributions that have materially enhanced the public's understanding of the earth sciences or significantly served decision makers in the application of scientific and technical information in public affairs and public policy related to the earth sciences. This may be accomplished by individual achievement through:

- ▲ authorship of educational materials of high scientific quality that have enjoyed widespread use and acclaim among educators or the general public;
- ▲ acclaimed presentations (books and other publications, mass and electronic media, or public presentations, including lectures) that have expanded public awareness of the earth sciences;
- ▲ authorship of technical publications that have significantly advanced scientific concepts or techniques

applicable to the resolution of earth-resource or environmental issues of public concern; or,

- ▲ other individual accomplishments that have advanced the earth sciences in the public interest.

The award will normally go to a GSA member, with exceptions approved by Council. It may be presented posthumously to a descendant of the awardee.

The nomination packet should include a nomination form, a letter of nomination, a brief biographical sketch (clearly demonstrating applicability to the selection criteria listed above), and a selected bibliography of no more than 10 titles. The nomination form and instructions are available at www.geosociety.org under Grants, Awards & Medals. A nomination form may also be obtained from the Program Officer, Grants, Awards, and Recognition, (303) 357-1028, awards@geosociety.org. **The deadline for receipt of nominations is February 1, 2005.**

Subaru Outstanding Woman in Science Award

Sponsored by Subaru of America, Inc.



The Subaru Outstanding Woman in Science Award was created to recognize a woman who has had a major impact on the field of the geosciences based on her Ph.D. research. The generous support of Subaru of America, Inc., in conjunction with the Doris M. Curtis Fund makes this award possible. Doris Curtis was GSA's 103rd president. Her popularity was widespread, and she pioneered many new directions for geology, not the least of which was her tenure as GSA president after an unbroken chain of 102 men. Causes dear to her were women, public awareness, minorities, and education.

Women are eligible for the first 3 years following their degree. The 2005 award will be \$2,500, and it will be presented at the 2005 Salt Lake City Annual Meeting.

The award recipient for 2004, Costanza Bonadonna, will receive her award at the President's Student Breakfast at the GSA Annual Meeting in Denver on Sunday, November 7, for her thesis work "Models of Tephra Dispersal."

Nominations must include a nomination form, a nominating letter that clearly states how the Ph.D. research has impacted the geosciences in a major way, a short summary of the research, a short resume with a list of publications, and a copy of the dissertation abstract, published abstracts, and/or reprints as available. The nomination form and instructions are available at www.geosociety.org under Grants, Awards & Medals. A nomination form may also be obtained from the Program Officer, Grants, Awards, and Recognition, (303) 357-1028, awards@geosociety.org. **The deadline for receipt of nominations is February 1, 2005.**

John C. Frye Environmental Geology Award

In cooperation with the Association of American State Geologists (AASG), GSA makes an annual award for the best paper on environmental geology published either by GSA or by one of the state geological surveys. The award is a \$1,000 cash prize from the endowment income of the GSA Foundation's John C. Frye Memorial Fund.

Criteria for Nomination

Nominations can be made by anyone on the basis of the following criteria: (1) paper must be selected from GSA or state geological survey publications, (2) paper must be selected from those published during the preceding three full calendar years, (3) nomination must include a paragraph stating the pertinence of the paper, and (4) nominations must be sent to Program Officer, Grants, Awards, and Recognition, GSA, P.O. Box 9140, Boulder, CO 80301-9140.

Deadline: March 31, 2005.

continued on page 51

Call for Nominations

Frye Award continued from page 50

Basis for Selection

Each nominated paper will be judged on the uniqueness or significance as a model of its type of work and report and its overall worthiness for the award. In addition, nominated papers must establish an environmental problem or need, provide substantive information on the basic geology or geologic process pertinent to the problem, relate the geology to the problem or need, suggest solutions or provide appropriate land use recommendations based on the geology, present the information in a manner that is understandable and directly usable by geologists, and address the environmental need or resolve the problem. It is preferred that the paper be directly applicable by informed laypersons (e.g., planners, engineers).

2004 Award Recipients Named

The 2004 award will be presented at the GSA Annual Meeting in Denver to Raymond C. Harris and Philip A. Pearthree, for *A Home Buyer's Guide to Geologic Hazards in Arizona*, published in the Arizona Geological Survey's Down-To-Earth 13, 2002.

GSA Distinguished Service Award

GSA Council established the GSA Distinguished Service Award in 1988 to recognize individuals for their exceptional service to the Society. GSA Members, Fellows, Associates, and employees may be nominated for consideration. Any GSA member or employee may make a nomination for the award. The Executive Committee will select awardees, and the Council must ratify all selections. Awards may be made annually, or less frequently, at the discretion of Council. This award will be presented during the Annual Meeting of the Society.

The nomination should include a nomination form, a letter of nomination, a brief biographical sketch, and a summary (200 words or less) of the candidate's contributions to the Society. The nomination form and instructions are available at www.geosociety.org under Grants, Awards & Medals. A nomination form may also be obtained from the Program Officer, Grants, Awards, and Recognition, (303) 357-1028, awards@geosociety.org. **The deadline for receipt of nominations is February 1, 2005.**

National Awards for 2007

Deadline: April 30, 2005

Nominations for the national awards described below are being solicited for 2007. GSA members are invited to nominate colleagues by sending background information and vitae, specifying the award for which the candidate is being submitted, to Program Officer, Grants, Awards, and Recognition, GSA, P.O. Box 9140, Boulder, CO 80301-9140, (303) 357-1028, fax 303-357-1070. On behalf of its member societies, the American Geological Institute (AGI) coordinates the nomination process. The AGI Member Society Council will finalize a roster of candidates at its spring 2005 meeting for nomination to the respective offices sponsoring the national awards.

The **William T. Pecora Award**, sponsored jointly by NASA and the Department of the Interior, is presented annually in recognition of outstanding contributions of individuals or groups toward the understanding of Earth by means of remote sensing. The award recognizes contributions of those in the scientific and technical community as well as those involved in the practical application of remote sensing. Consideration will be given to sustained or single contributions of major importance to the art or science of understanding Earth through observations made from space.

The president of the United States awards the **National Medal of Science** to individuals "deserving of special recognition by reason of their outstanding contributions to knowledge in the physical, biological, mathematical, engineering, or social and behavioral sciences." There are now many younger American scientists and engineers who may be reaching a point where their contributions are worthy of recognition. The committee is giving increasing attention to these individuals as well as to those outstanding women and minority scientists who deserve recognition.

The **Vannevar Bush Award** is presented from time to time to a person who, through public service activities in science and technology, has made an outstanding contribution toward the welfare of mankind and the nation. The award is given to a senior statesman of science and technology and complements the National Science Foundation's **Alan T. Waterman Award**, which is given to a promising young scientist. The two awards are designed to encourage individuals to seek the highest levels of achievement in science, engineering, and service to humanity. The nomination should be accompanied by a complete biography and a brief citation summarizing the nominee's scientific or technological contributions to our national welfare in promotion of the progress of science.

The **Alan T. Waterman Award** is presented annually by the National Science Foundation (NSF) and National Science Board to an outstanding young researcher in any field of science or engineering supported by NSF. Candidates must be U.S. citizens or permanent residents and must be 35 years of age or younger, OR not more than five years beyond receipt of the Ph.D. degree by December 31 of the year in which they are nominated. Candidates should have completed sufficient scientific or engineering research to have demonstrated, through personal accomplishments, outstanding capability, and exceptional promise for significant future achievement.

Note: Background information and vitae of nominated candidates should be sent by **April 30, 2005**, to the Program Officer, Grants, Awards, and Recognition, GSA, P.O. Box 9140, Boulder, CO 80301-9140.

DROWNING THE NORTH CAROLINA COAST: Sea-Level Rise and Estuarine Dynamics

By Stanley R. Riggs and Dorothy V. Ames



N.C. Sea Grant publication provides in-depth information on erosion rates along estuarine shorelines. Includes full-color photos and maps; \$26.

For ordering information: 919/515-9101,
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• CALIFORNIA BAY-DELTA AUTHORITY SCIENCE PROGRAM •

The California Bay-Delta Authority Science Program is announcing its first solicitation for research proposals in support of the CALFED Bay-Delta Program. Approximately \$18-\$20 million will be available for research in three broad topic areas:

•
Improve knowledge of key aquatic species and how water management activities affect populations across broad spatial and temporal scales from upstream rivers through the San Francisco Estuary

•
Further develop understanding of ecosystem processes in the Sacramento-San Joaquin Delta, Suisun Marsh, and upstream rivers and their relationship to factors critical for water and aquatic species management

•
Provide a framework for assessing how future changes such as population or climate-related hydrological shifts may affect water operations and ecosystem processes, and the success of CALFED projects

To access information about this opportunity, as well as an additional \$20 million available through the CALFED Bay-Delta Program's solicitation for monitoring and evaluation of its ecosystem restoration actions, please visit:

<https://solicitation.calwater.ca.gov>

For additional information, e-mail help@solicitation.calwater.ca.gov
or call the PSP Helpline at 877/408-9310



2005 Jahns Distinguished Lecturer Named

Richard M. (Dick) Iverson has been named the 2005 Jahns Distinguished Lecturer. The Association of Engineering Geologists and GSA's Engineering Geology Division jointly established the Richard H. Jahns Distinguished Lectureship in 1988 to commemorate Jahns and to promote student awareness of engineering geology through a series of lectures offered at various locations around the country throughout the year. Richard H. Jahns (1915–1983) was an engineering geologist who had a diverse and distinguished career in academia, consulting, and government.

Richard Iverson is a graduate of Iowa State University (B.S., 1977) and Stanford University (M.S., 1980; M.S., 1981; Ph.D., 1984), where he was a student in several of Richard Jahns' classes and subsequently a teaching assistant to Jahns in his graduate course in engineering geology. Since 1984, Iverson has worked at the U.S. Geological Survey's Cascades Volcano Observatory in Vancouver, Washington, where his current position is senior research hydrologist.

Iverson is a Fellow of GSA and a past recipient of the Society's E.B. Burwell Award (1991) and Kirk Bryan Award (2001). Much of his research has emphasized the mechanics of post-failure landslide and debris-flow motion, model-

ing and measurement of hydrologic processes that trigger landslides, and statistical forecasting of areas likely to be inundated by future landslides and debris flows. Iverson has also worked on diverse topics, ranging from erosion of desert soils to deformation of subglacial till layers and volcanic lava domes. He instigated construction of the USGS debris-flow flume in central Oregon in 1991 and thereafter has directed research at the facility. He is an affiliated professor at the University of Washington, Seattle, and an adjunct professor at Portland State University, and he was recently a guest scientist at the Isaac Newton Institute for Mathematical Sciences, Cambridge University.

The 2005 Jahns lectures are titled "Dynamics of Debris Flows and Rock Avalanches" and "Long-Term Behavior of Slow-Moving Landslides: Measurements and Mechanics." Both lectures will include video footage of relevant experiments conducted at the USGS debris-flow flume as well as descriptions of pertinent field data and mechanical analyses. Iverson will deliver whichever lecture is requested.

Requests for scheduling lectures should be directed to Richard Iverson at riverson@usgs.gov.

Future GSA Annual Meetings

2005

Salt Lake City
(October 16–19)

2006

Philadelphia
(October 22–25)

2007

Denver
(October 28–31)

2008*

Chicago
(October 26–30)

2009

Portland, Ore.
(tentative; October 18–21)

2010

Denver
(October 31–November 3)

2011

Minneapolis
(tentative; October 9–12)

* Joint meeting with
American Society of Agronomy,
Crop Science Society of
America, and Soil Science
Society of America.

ATTENTION Employers and Job Seekers!

Whether you're looking to fill positions with qualified candidates or seeking employment in the geosciences, take advantage of GSA's Employment Service Center at GSA's Annual Meeting.

For details, visit our Web site at www.geosociety.org and click "**employment opportunities.**"



The Earth Machine

The Science of a Dynamic Planet

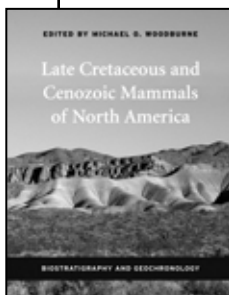
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Webster take you on a voyage of discovery through their engagingly written and beautifully illustrated book."—Brian Skinner, Yale University, and author of *The Blue Planet*

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Biostratigraphy and Geochronology

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This book places into modern context the information by which North American mammalian paleontologists recognize, divide, calibrate, and discuss intervals of mammalian evolution known as North American Land Mammal Ages. It incorporates new information on the systematic biology of the fossil record and utilizes the many recent advances in geochronologic methods and their results.

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This book surveys the past, present, and potential future variability of hurricanes and typhoons on a variety of timescales using newly developed approaches based on geological and archival records, in addition to more traditional approaches based on the analysis of the historical record of tropical cyclone tracks.

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PENROSE CONFERENCE SCHEDULED

Kinematics and Geodynamics of Intraplate Dextral Shear in Eastern California and Western Nevada

April 21–26, 2005

**Mammoth Mountain Inn,
Mammoth Lakes, California**

Conveners:

Jeffrey Lee, Department of Geological Sciences, Central Washington University, Ellensburg, Washington 98926, USA, (509) 963-2801, jeff@geology.cwu.edu

Daniel Stockli, Geology Department, University of Kansas, Lawrence, Kansas 66045, USA, (785) 864-4995, stockli@ku.edu

Christopher Henry, Nevada Bureau of Mines and Geology, University of Nevada, Reno, Nevada 89557, USA, (775) 784-6691, chenry@unr.edu

Timothy Dixon, RSMAS-MGG, Miami University, Miami, Florida 33149, USA, (305) 361-4660, tdixon@rsmas.miami.edu

Description and Objectives. A diverse group of geoscientists is investigating several principal questions in continental dynamics. How is intraplate deformation accommodated? Is intraplate strain localized along a few discrete faults or is strain accommodated across a wide zone of deformation? How is strain distributed in space and time? What geologic and/or geophysical processes control strain localization? One of the premier examples of intracontinental deformation is the Eastern California Shear Zone (ECSZ)/Walker Lane Belt (WLB). This deformation belt is an ideal location to characterize and understand the initiation and evolution of a 3-D intraplate strain field associated with an active and evolving plate boundary zone and to better constrain the forces driving deformation.

This conference will bring together researchers from a number of geoscience disciplines working in this region to discuss the range of geological and geophysical data sets that bear on how intraplate deformation is accommodated and how best to integrate these data sets into a spatially and kinematically

coherent and comprehensive view of intraplate deformation through time. The conveners invite participants whose research in this region spans diverse fields including active tectonics, structural geology, igneous petrology, geodesy, geophysics, paleoseismology, geodynamic modeling, and geomorphology. We'll discuss what we know about deformation in this region at a range of spatial and temporal scales, how to integrate the longer temporal view provided by geologic data with the instantaneous present-day view provided by geodetic and geophysical data, what forces drive deformation, the uncertainties associated with interpretations, and where further research should focus.

Outline. The conference will include a one-day field trip and three days of oral and poster presentations and discussions. All participants are expected to contribute a poster or oral presentation. Participants arrive by late afternoon, April 21, at Mammoth Mountain Inn in Mammoth Lakes, California. To set the stage for the conference, we'll discuss the plate tectonic setting and regional geologic setting for the ECSZ/WLB during the evening of the 21st. A field trip the following day will examine field evidence for recent dextral, sinistral, and normal faulting in the ECSZ and WLB and to discuss the timing of faulting and estimated geologic slip rates along these faults. The trip will introduce the second day of the conference, during which sessions on the spatial and temporal distribution of intraplate deformation will be the focus. Discussions will center on geologic and geodetic slip-rate estimates along faults within the ECSZ/WLB. Geologic and geodetic slip-rate estimates allow us to quantify the spatial distribution of strain, yet often a discrepancy between the two different data sets exists. We'll address how to integrate these often disparate data sets into an internally consistent spatial and temporal kinematic model of fault slip distribution, and the process or set of processes that result in this discrepancy. Two themes will be the center of our discussions during the third day of the conference. Building upon our discussions during the previous day, the first session will focus on the interplay between tectonics and climate and using surface processes and geomorphology to bridge the gap between geologic and geodetic time scales. The second session on the spatial and temporal relation between magmatism and deformation will try to answer whether there is a causal relation between magmatism and faulting, and what role magmatism plays in the localization of strain. Discussions during the first three days form the foundation for the last day, which will concentrate on the implications of geodetic data for crustal structure and modeling geological and geophysical data to characterize the driving forces for strain localization and migration. Given our understanding of the spatial and temporal distribution of strain localization, a key question we hope to answer is what is the nature of coupling between lithospheric processes and strain localization in the upper crust and the forces that drive intraplate deformation? Participants depart on the morning of April 26.

Venue. Mammoth Lakes is located along a beautiful part of the eastern Sierra Nevada, a few miles west of Long Valley

Caldera and within easy driving distance of many active or recently active strike-slip and normal faults of the ECSZ/WLB region. The estimated registration fee of \$1,000 will cover lodging, all meals, and the field trip, but will not cover transportation to the meeting site. The closest large airport is in Reno, Nevada, 165 miles to the north.

Field Trip. A one-day field trip will focus on the northern part of the ECSZ and southern part of the WLB. The ECSZ area is dominated by dextral faulting, displacement transfer of normal faults, and no apparent vertical axis rotations, whereas the southern part of the WLB includes dextral faulting, normal faults, left-lateral faults, and possibly vertical axis rotations. The field trip will visit localities along the White Mountains fault zone, the Deep Springs fault, the Fish Lake Valley fault zone, the Coaldale fault, and Queen Valley fault which provide evidence for Pleistocene and younger dextral, sinistral, and normal fault slip.

Application Deadline:
January 5, 2005. Geoscientists interested in the recent kinematic and geodynamic evolution of the ECSZ/WLB and the processes of intraplate deformation are encouraged to apply. Send a letter of application to Danny Stockli or Chris Henry (addresses above) that includes a brief statement of interests, the relevance of your recent work to the themes of the meeting, the subject of proposed presentation, and contact information. Interested graduate students are strongly encouraged to apply; partial support is available. Invitations will be e-mailed to participants in mid-February 2005.

Registrants with Special Needs.
GSA is committed to making Penrose Conferences accessible to all. If you require special arrangements or have special dietary concerns, please contact one of the conveners.

International Ground Water Modeling Center 2004 Short Course Schedule

Plan to Learn More Modeling Skills During Your GSA Trip

MODFLOW: Introduction to Numerical Ground-Water Modeling by Eileen Poeter, November 4-6

This course is designed for the hydrogeologist and environmental engineer familiar with ground-water flow concepts, but who have limited or no experience with ground-water flow modeling. Basic modeling concepts: conceptual model development, definition of boundary and initial conditions, parameter specification, finite-differencing, gridding, time stepping, solution control, and calibration are presented using MODFLOW-2000. Registration fee: \$995/\$1195 after Oct. 21.

Polishing Your Ground-Water Modeling Skills by Peter Andersen and Robert Greenwald, November 4-6

This course is designed to provide significant detail on practical ground-water flow modeling concepts and techniques. It will explore development of conceptual models for complex sites or regions. This course takes the user beyond topics covered in introductory modeling courses and beyond courses that teach the mechanics of applying various pre- and post-processing software. Registration fee: \$995/\$1195 after Oct. 21.

Modeling Water Flow & Contaminant Transport in Soils and Groundwater Using the HYDRUS Software Packages by Rien van Genuchten and Jirka Simunek, November 5-6

This course begins with a detailed conceptual and mathematical description of water flow and solute transport processes in the vadose zone, followed by an brief overview of the use of finite element techniques for solving the governing flow and transport equations. "Hands-on" computer sessions will provide participants an opportunity to become familiar with the Windows-based HYDRUS1D, HYDRUS2D, STANMOD, & RETC software packages. Registration fee: \$495/\$595 after Oct. 21.

UCODE: Universal Inversion Code for Automated Calibration by Eileen Poeter, November 11-12

If you have a working knowledge of ground-water flow modeling and some knowledge of basic statistics, you will benefit from this short course. This course introduces ground-water professionals to inverse modeling concepts and their use via UCODE, relying heavily on hands-on exercises for automatic calibration of ground-water models to promote understanding of UCODE and avoid "black-boxing". If you would like to spend more time being a hydrologist and less time as a "number tweaker", please join us in the UCODE course. The latest version to be released in 2004 will be used. Registration fee: \$795/\$995 after Oct. 28.

For more information, contact: International Ground-Water Modeling Center

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Silent Auction Fun at the GSA Foundation Booth

While you are at the GSA Annual Meeting in November, make it a priority to stop by the Foundation booth in the Exhibit Hall of the Colorado Convention Center to participate in the Silent Auction of more than 200 items. Bidding will be accepted at the Foundation booth from Sunday evening, November 7, until 10 a.m. Wednesday, November 10. The auction is a great place for you to get meal certificates, Christmas gifts, vacation packages, rock and mineral specimens, and other fun items donated by Foundation supporters.

If you're looking for a great place to have a meal while attending the convention, stop by the Silent Auction and bid on gift certificates for meals from the area's finest restaurants. This year, many Denver businesses have donated gift certificates for meals and other items and events that you can enjoy during your convention visit.

Remember to bid on one or more vacation or lodging packages donated to us by members. We anticipate some exciting choices that last year included stays in Santa Fe, the Oregon Coast, the Columbia River Gorge, and West Yellowstone. We hope to have these places available this year in addition to choices in Cozumel and Florida. You won't find a better way to secure a wonderful location for your getaway while at the same time contributing greatly to the support of GSA.

Your financial participation in the auction results in money for a number of GSA needs. Last year, the Foundation auction raised about \$13,000, which supported student travel grants to GSA meetings, both domestic and international, and student research grants. We encourage you to help us make this year's auction even more successful.

Have an Item to Donate?

You can donate items such as rare geologic books, geologic software, fossils, mineral specimens, jewelry, rare geologic maps, wine, field supplies, and antiques, just to name a few. Do you have days at a timeshare that you would be willing to donate? Last year, bidders enthusiastically pursued timeshares from a variety of places around the country.

Your donation is tax deductible based upon the retail value of the donated item. If you don't have an item, we'd be happy to accept a cash donation. Your name will be listed as the donor on the auction item displayed in the Foundation booth.

You may mail donations to Auction Chair Tom Fouch, P.O. Box 1008, Morrison, CO 80465, USA. For further information, please contact Tom at tsfouch@earthlink.net, or (303) 986-7695.

Planned Giving Seminar

The Foundation will be hosting a Planned Giving Seminar during the GSA Annual Meeting in Denver.

Janet Doolan, from Doolan Training & Consulting, will be conducting the seminar on planned giving and endowment options and the basic steps and benefits of both.

So, don't delay—entry to this seminar is free, but you MUST make a reservation, as we are limited to no more than 50 people. Please contact Donna Russell at (303) 357-1054 or drussell@geosociety.org to reserve a place for this informative seminar.

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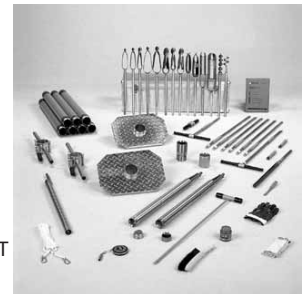


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GSA Today (Publication No. 1052-5173) is published monthly by The Geological Society of America, Inc., (GSA) with headquarters and offices at 3300 Penrose Place, Boulder, Colorado 80301 U.S.A.; and mailing address of Post Office Box 9140, Boulder, Colorado 80301-9140 U.S.A. The Publisher is Jon Olsen; the Managing Editor is Jeanette Hammann; their office and mailing addresses are the same as above. The annual subscription prices are: for Members and Student Associates, \$13; for non-members \$75. The publication is wholly owned by The Geological Society of America, Inc., a not-for-profit, charitable corporation. No known stockholder holds 1 percent or more of the total stock. CEDE & Company, 55 Water Street, New York, NY 10041, holds all outstanding bonds; there are no known mortgagees or holders of other securities. The purpose, function, and nonprofit status of The Geological Society of America, Inc., have not changed during the preceding twelve months. The average number of copies of each issue during the preceding twelve months and the actual number of copies published nearest to the filing date (September 2004 issue) are noted at right.

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Research Grant Policies, Procedures, and Application Forms

The primary role of the GSA research grants program is to provide partial support of master's and doctoral thesis research in the geological sciences for graduate students at universities in the United States, Canada, Mexico, and Central America. In 2004, 47% of the applicants received funding with the average award being \$1,750. GSA strongly encourages women, minorities, and persons with disabilities to participate fully in this grants program.

NEW in 2005

The 2005 GSA student research grant application process will be available online only. Although the current forms will not change significantly in nature, the process for submitting applications and appraisal letters will be accessible only through GSA's password-protected Web site. No paper applications or letters will be accepted. Please check *GSA Connection* and upcoming e-mails for updates. The site should be live by mid-November. The deadline for proposal submission will be *midnight MST, February 1, 2005*.

Eligibility

- Applicants (U.S. or non-U.S.) must be currently enrolled in a U.S., Canadian, Mexican, or Central American university or college in a geological science degree program.
- Eligibility is restricted to GSA members. To become a GSA member, please visit www.geosociety.org/members.
- You must have a valid e-mail address to apply.
- Gender is not considered in the determination of minority status.

Deadlines

- All applications and appraisal forms must be submitted by *midnight MST, February 1, 2005*.
- Award letters will be mailed out in late April. Results will not be disclosed by e-mail or telephone.

Applications

- To apply, please visit www.geosociety.org/grants/gradgrants.htm.

Appraisal Forms

- Two appraisals are required with each application. One evaluation must come from a current advisor. Advisors do not have to be members of GSA or come from the same institution as the applicant.
- Appraisal Forms must be submitted by the advisors online via the password-protected submission process. No mailed letters of reference will be considered.
- Applications missing any appraisal forms will not be eligible.

Progress Report Forms

- All grant recipients are required to submit a progress report by January 31, 2006.
- A progress or final report (in PDF format), completed for any previous GSA research grant must be submitted with the current proposal regardless if one has been submitted to GSA for other purposes.

For additional information, please visit

[www.geosociety.org/grants/
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or contact:

GSA Program Officer

Grants, Awards, and Recognition

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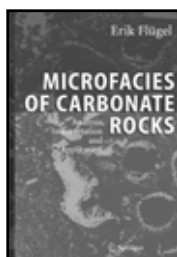
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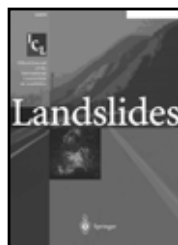
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Please stop by booth 919 at the GSA meeting to browse our titles, all available at a 20% conference discount.

Attention professors...

Springer's newest textbooks include *Rock Mechanics, Third Edition* (Brady, Bown), *Clays* (Meunier), *Mud and Mudstone* (Potter, et al.) and *Physics of Sedimentology, Second Edition* (Hsi). Request your exam copy at GSA in time for next semester's planning.

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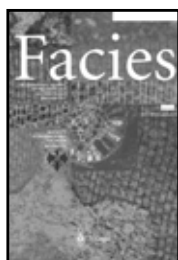


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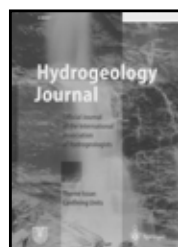


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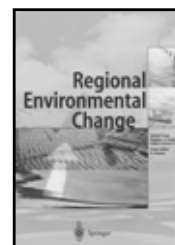
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GSA is seeking candidates to serve on Society committees and as GSA representatives to other organizations. Contribute to our science by volunteering yourself or nominating others you think should be considered for any of the following openings. Younger members are especially encouraged to become involved in Society activities. If you volunteer or make recommendations, please give serious consideration to the specified qualifications for serving on a particular committee. **Please be sure that your candidates are GSA Members or Fellows and that they fully meet the requested qualifications.**

You may now volunteer or nominate online. The nomination form and instructions are available at www.geosociety.org/aboutus/commtees. Click on the **2005–2006 Nomination Form** link to access the form. For questions pertaining to nominations, please contact Ruth Harrison at (303) 357-1000, ext. 0, 1-800-472-1988, or rharrison@geosociety.org.

Nominations received at GSA headquarters by **January 15, 2005**, on the official one-page form will be forwarded to the Committee on Nominations. *Council requires that the form be complete.* Information requested on the form will assist the committee members with their recommendations for the July 2005 committee vacancies. Please use one form per candidate. The committee will present at least two nominations for each open position to the Council at its spring meeting. Appointees will then be contacted and asked to serve, thus completing the process of bringing new expertise into Society affairs.

Graduate Students: You are eligible to serve on GSA committees as full members, and Council encourages you to volunteer or nominate others for committee service.

July 2005 Committee Vacancies

Annual Program Committee

(AM, B/E, T/E)

2 vacancies: 1 member-at-large; 1 councilor

Develops a long-range plan for increasing the quality of the GSA Annual Meeting and other Society-sponsored meetings in terms of science, education, and outreach. Evaluates the technical and scientific programs of the GSA Annual Meeting. **Qualifications:** broad familiarity with different disciplines, previous program experience, or active involvement in applying geologic knowledge to benefit society and raising awareness of critical issues.

Arthur L. Day Medal Award (T/E)

3 vacancies: 2 member-at-large vacancies; 1 councilor or former councilor

Selects candidates for the Arthur L. Day Medal Award. **Qualifications:** knowledge of those who have made “distinct contributions to geologic knowledge through the application of physics and chemistry to the solution of geologic problems.”

Education (AM, B/E)

3 vacancies: 1 precollege level educator (K–12); 1 member-at-large; 1 student representative

Stimulates interest in the importance and acquisition of basic knowledge in the earth sciences at all levels of education and promotes the importance of earth-science education to the general public. **Qualifications:** ability to work with other interested scientific organizations and science teachers’ groups to develop precollege earth science education objectives and initiatives.

Geology and Public Policy

(AM, B/E, T/E)

2 member-at-large vacancies

Translates knowledge of earth sciences into forms most useful for public discussion and decision making. **Qualifications:** experience in public-policy issues involving the science of geology; ability to develop, disseminate, and translate information from the geo-

logic sciences into useful forms for the general public and for GSA members; familiarity with appropriate techniques for the dissemination of information.

Honorary Fellows (T/E)

2 member-at-large vacancies

Selects candidates for Honorary Fellows, usually non-North Americans. **Qualifications:** knowledge of geologists throughout the world who have distinguished themselves through their contributions to the science.

Joint Technical Program Committee (B/E, T/E)

2 vacancies: 1 Paleooceanography/Paleoclimatology representative; 1 Precambrian Geology Representative (terms begin January 1, 2006)

Assists in finalizing the technical program of the GSA Annual Meeting: reviews abstracts or provides names of reviewers to evaluate abstracts, participates in the Web-based activities in the selection and scheduling of abstracts, participates in Topical Session proposal review. **Qualifications:** should be a specialist in computers and marine geology, and must be able to attend a meeting in late summer.

Membership (B/E)

2 member-at-large vacancies: (requires members from the employment categories of government and industry)

Evaluates membership benefits and develops recommendations that address the changing needs of the membership and attracts new members.

Qualifications: experience in benefit, recruitment, and retention programs is desired.

Minorities and Women in the Geosciences (AM)

5 member-at-large vacancies; 1 councilor

Stimulates recruitment and promotes positive career development of minorities and women in the geoscience professions. **Qualifications:** familiarity with

minority and female education and employment issues; expertise and leadership experience in such areas as human resources and education.

Nominations (B/E)

2 member-at-large vacancies

Recommends to the Council nominees for the positions of GSA Officers and Councilors, committee members, and Society representatives to other permanent groups. **Qualifications:** familiarity with a broad range of well-known and highly respected geological scientists.

Penrose Conferences and Field Forums (AM, T/E)

1 member-at-large vacancy

Reviews and approves Penrose Conference proposals and recommends and implements guidelines for the success of the conferences. **Qualifications:** past convener of a Penrose Conference or a Field Forum.

Penrose Medal Award (T/E)

3 vacancies: 2 member-at-large vacancies; 1 councilor

Selects candidates for the Penrose Medal Award. Emphasis is placed on "eminent research in pure geology, which marks a major advance in the science of geology." **Qualifications:** familiarity with outstanding achievements in the geological community that are worthy of consideration for the honor.

Professional Development

(T/E)

3 vacancies: 2 members-at-large; 1 student representative

Directs, advises, and monitors GSA's professional development program, reviews and approves proposals, recommends and implements guideline changes, and monitors the scientific quality of courses offered. **Qualifications:** familiarity with professional development programs or adult education teaching experience.

Publications (AM, B/E, T/E)

2 vacancies: 1 member-at-large, 1 councilor

Nominates candidates for editors' positions; approves of editorial boards; reviews the quality and health of Society publications; explores the initiation of new ventures as well as cessation of

existing publications. **Qualifications:** extensive publications experience.

Public Service Award (T/E)

1 member-at-large vacancy

Generates, receives, and evaluates candidates for the GSA Public Service Award. **Qualifications:** knowledge of those whose contributions and accomplishments have enhanced the public's understanding of earth science.

Research Grants* (B/E)

4 member-at-large vacancies (one to be based locally from the Colorado area)

Evaluates research grant applications and selects grant recipients. **Qualifications:** should have experience in directing research projects and in evaluating research grant applications.

Young Scientist Award

(Donath Medal) (T/E)

2 member-at-large vacancies (one to be filled by a councilor/former councilor)

Committee members investigate the achievements of young scientists who should be considered for this award and submit recommendations to Council. **Qualifications:** should have knowledge of young scientists with "outstanding achievement(s) in contributing to geologic knowledge through original research which marks a major advance in the earth sciences."

Representative to the North

American Commission on Stratigraphic Nomenclature

1 vacancy

Must be familiar with and have expertise in stratigraphic nomenclature.

GSA Conferee to the AAPG

Publication Pipeline Committee (B/E)

1 vacancy

Improves geoscience education in developing countries by providing used geoscience books and periodicals at no cost to university libraries and other libraries that request them.

Qualifications: should have contacts within both the U.S. and foreign academic communities; knowledge of the activities of GSA.

GSA Representative to the AGI

Environmental Geoscience Advisory Committee (B/E)

1 vacancy

Fosters communications within the community about issues related to serving the broader international community; helps identify and focus on the highest priority environmental informational needs and issues best addressed by the geoscience community. **Qualifications:** well acquainted with GSA programs in environmental geoscience.

GSA Representative to the AAAS

Consortium of Affiliates for International Programs (B/E)

1 vacancy

Encourages cooperation on projects with international aspects and facilitates networking in its member societies. **Qualifications:** must be a member of the AAAS, or willing to join.

Committee, Section, and Division Volunteers: Council Thanks You!

The GSA Council acknowledges the many member-volunteers who, over the years, have contributed to the Society and to our science through involvement in the affairs of the GSA.

Each year, GSA asks for volunteers to serve on committees, and many highly qualified candidates express their willingness to serve. Not everyone can be appointed to the limited number of vacancies; however, members are reminded that there are also opportunities to serve in the activities and initiatives of the GSA Sections and Divisions. Annually, the Council asks GSA Sections and Divisions to convey the names of potential candidates for committee service to the Committee on Nominations.

KEY * Extensive time commitment required; AM—Meets at Annual Meeting; B/E—Meets in Boulder or elsewhere; T/E—Communicates by phone or electronically

PROPOSED STATEMENT ON GEOSCIENTISTS AND NATURAL HAZARD POLICY: Panel Seeks Help

The need for geoscientific input when natural disasters strike goes without saying. However, career policy workers and the general public need to communicate the benefits of having an emergency plan that has been developed by accurate forecasting of potential hazards. In response to this need, GSA has formed a panel of experts to prepare a statement presenting the geoscientists' perspective on natural hazards policy in the United States and around the world.

Putting aside the fascinating, complex, and often debatable issues related to the recurrence rates for extreme natural events, such as floods, landslides, hurricanes, earthquakes, and volcanic eruptions, there is little doubt that the nature and severity of the impact of such events has grown with population growth and the many rapid and ongoing changes in our modern society. Reasons for our increased vulnerability to natural events include:

- more people live on marginal lands subject to various hazards;
- we increasingly store and transport large quantities of hazardous materials in structures, the integrity of which can be compromised by extreme events;
- modern economies depend on large-scale infrastructure networks (e.g., roads, pipelines, telecommunications) that have proven both fragile and costly to repair when damaged; and
- globalization of the world economy has broadened the impact "footprint" well beyond the geography of direct physical effects from extreme natural events.

Whether an extreme event becomes a natural disaster and how bad the disaster will be depends on our ability to forecast,

prepare for, mitigate, and respond to the causative event. More and better information about the natural environment and natural earth systems is key to reducing loss of life and impact to our continually growing urban infrastructure. Therefore, the GSA Geology and Public Policy Committee recommends development of a GSA position statement to encourage support of research and teaching of the potential physical impacts and associated widespread societal effects of natural hazards. The persistent dissemination of such information by skilled geoscientists and their colleagues in the engineering and community planning professions will help promote the incorporation of the required resilience and pre-disaster planning within the national and global infrastructure to minimize the impacts of natural hazards.

GSA's panel on geoscientists and natural hazards includes: David Applegate, U.S. Geological Survey; Vic Baker, University of Arizona; Susan Cannon, U.S. Geological Survey; John Costa, U.S. Geological Survey; Co-Chair Lou Gilpin, Gilpin Geosciences, Inc.; Co-Chair George Linkletter, Environ Corporation; and Orrin Pilkey, Duke University.

Panel members would like input from a broad range of GSA members on this issue. They are particularly interested in examples of how geoscientists have participated in public policy-making processes regarding natural hazards both in anticipation of future forecasts, as well as in retrospect, in the aftermath of recent local or regional events. If you have information that you think would be helpful, please contact either of the co-chairs, Lou Gilpin or George Linkletter.

Letter.....

Dear Editor,

We write to encourage GSA journals to conform to the Systeme International (SI) regarding units of time. The SI unit of time, the second (s), is impractical for earth scientists, astronomers and nuclear physicists alike. In such cases, the SI tolerates other units, and for geological applications the annum (a) is used, where $1 a = 3.16 \times 10^7 s$ (Holden, 2001). As with other units, thousands, millions, and billions of these are appropriately designated ka, Ma, and Ga, respectively. So far, so good—these derived units are in widespread use in earth science literature. The departure lies in the use of different units (e.g., m.y.) for time differences such that the interval between 90 Ma and 100 Ma, for example, would be designated as 10 m.y. in, e.g., *Geology*. Following correct SI usage (Nelson, 2002) units must follow algebraic rules such as the distributive law: $100 Ma - 90 Ma = (100 - 90)Ma = 10 Ma$, and so on. Similarly, rates and decay constants should be expressed in $(ka)^{-1}$, $(Ma)^{-1}$ or $(Ga)^{-1}$. Analogies are useful: we would all agree

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that the interval between 100 m and 200 m depths in a borehole is 100 m, or that a magma at 1000 °C is 100 °C hotter than one at 900 °C. Why should we treat time units any differently? We urge GSA to abandon the policy of expressing time differences in k.y., m.y., or g.y., and thereby achieve compliance with the SI standard.

Sincerely,

Paul R. Renne and Igor M. Villa, co-chairs
IUGS Working Group on Decay Constants
in Geochronology

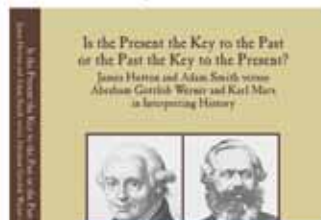
References Cited

- Holden, N.E., 2001, Table of the Isotopes, in *CRC Handbook of Chemistry and Physics*: CRC Press, Boca Raton, section 11, p. 50-197.
Nelson, R.A., 2002, Guide for metric practice: *Physics Today* 55, p. BG15-BG16.

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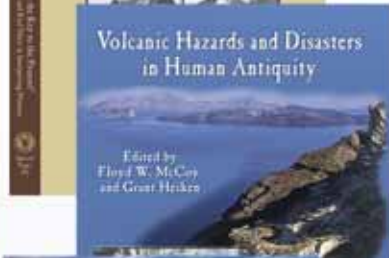


Is the Present the Key to the Past or the Past the Key to the Present?
James Hutton and Adam Smith versus Abraham Gottlob Werner and Karl Marx in Interpreting History



Is the Present the Key to the Past or the Past the Key to the Present? James Hutton and Adam Smith versus Abraham Gottlob Werner and Karl Marx in Interpreting History
by A.M.C. Şengör, 2001
SPE355, 51 p., ISBN 0-8137-2355-8
\$36.00, member price \$28.00

Tectonosomes and Olistostromes in the Argille Scagliose of the northern Apennines, Italy
by G.A. Pini, 1999
SPE335, 70 p., ISBN 0-8137-2335-3
\$25.00, member price \$20.00



Volcanic Hazards and Disasters in Human Antiquity

Edited by Floyd W. McCoy and Grant Heiken

Volcanic Hazards and Disasters in Human Antiquity
edited by Floyd W. McCoy and Grant Heiken, 2000
SPE345, 99 p., ISBN 0-8137-2345-0
\$35.00, member price \$28.00

Cenozoic Basins of the Death Valley Region
edited by L.A. Wright and B.W. Traxel, 1999
SPE333, 376 p., plus index, ISBN 0-8137-2333-7
\$40.00, member price \$32.00



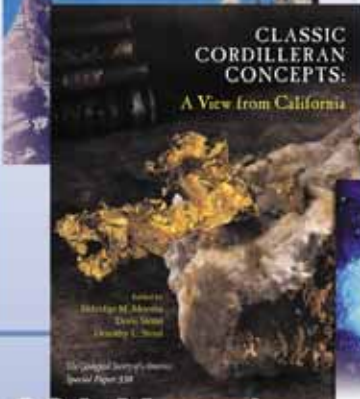
Structural Geology of the Colorado Plateau Region of Southern Utah

With Special Emphasis on Deformation Bands

George H. Davis

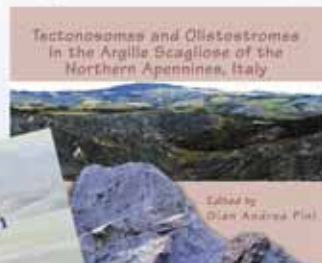
Structural Geology of the Colorado Plateau Region of Southern Utah, with Special Emphasis on Deformation Bands
by George H. Davis, 1999
SPE342, 157 p., ISBN 0-8137-2342-6
\$35.00, member price \$28.00

Evolution of the Cretaceous Ocean-Climate System
edited by E. Barrera and C.C. Johnson, 1999
SPE332, 436 p., plus index, ISBN 0-8137-2332-9
\$70.00, member price \$56.00



CLASSIC CORDILLERAN CONCEPTS:
A View from California

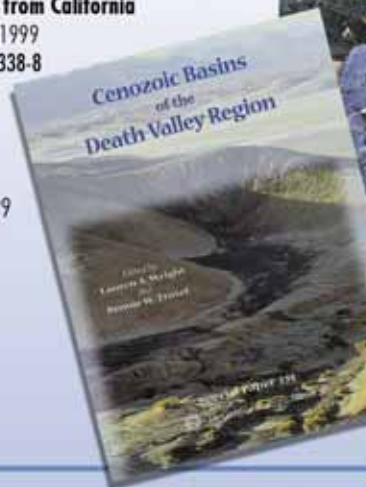
Classic Cordilleran Concepts: A View from California
edited by E.M. Moores, D. Sloan, D.L. Stout, 1999
SPE338, 481 p., plus index, ISBN 0-8137-2338-8
\$80.00, member price \$64.00
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Tectonosomes and Olistostromes in the Argille Scagliose of the Northern Apennines, Italy

Edited by Gian Andrea Pini

Glacial Processes Past and Present
edited by D.M. Mickelson and J.W. Attig, 1999
SPE337, 203 p., ISBN 0-8137-2337-X
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Cenozoic Basins of the Death Valley Region

Edited by Lawrence K. Wright and Bruce W. Traxel



Evolution of the Cretaceous Ocean-Climate System

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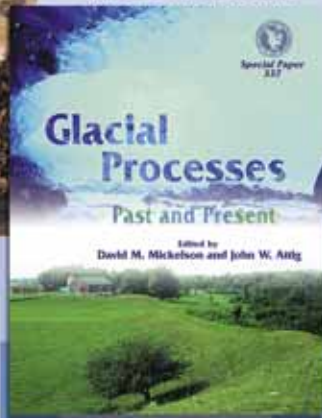


Pre-Mesozoic Ice Ages: Their Bearing on Understanding the Climate System

John C. Crowell

Memoir 92

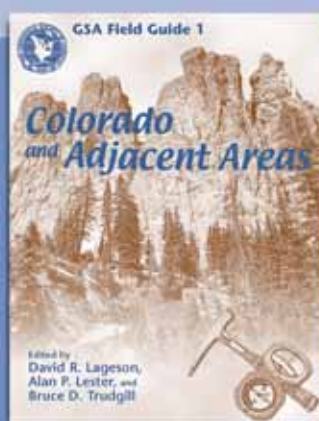
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Colorado and Adjacent Areas
edited by David R. Lageson, Alan P. Lester, and Bruce D. Trudgill, 1999
FLD001, 201 p., ISBN 0-8137-0001-9, softcover
\$35.00, member price \$28.00



Great Basin and Sierra Nevada

GSA Field Guide 3

Edited by David R. Lageson, Alan P. Lester, and Mary M. Lahren

Great Basin and Sierra Nevada
edited by David R. Lageson, co-editors Stephen G. Peters, and Mary M. Lahren, 2000
FLD002, 430 p., ISBN 0-8137-0002-4, softcover
\$55.00, member price \$44.00

STATEMENT ON THE OPEN ACCESS TO DATA: Panel Seeks Community Input

The free and open access to data is a prerequisite for conducting the next generation of earth science research and for providing the basis for the continued improvement of earth science education. The access to and synthesis of these data are important for building a broader public awareness of the importance of science to society. It is equally critical for providing the factual basis to decision-makers involved in environmental, natural resource, and global change issues. Therefore, GSA, through its Geology and Public Policy Committee (www.geosociety.org/science/govpolicy.htm) has formed a panel to assess this issue and develop a draft policy statement for the Society. Panel members are: Chaitan Baru, San Diego Supercomputer Center, University of California, San Diego; Cinzia Cervato, Iowa State University and CHRONOS; Emi Ito, Limnological Research Center, University of Minnesota; Christopher G. Maples, Desert Research Institute, University of Nevada; David Simpson, Incorporated Research Institutions for Seismology; Lynn Soreghan, University of Oklahoma and GeoSystems; and Walter Snyder, wsnyder@nsf.gov, National Science Foundation (NSF) and Boise State University, who is the chair and corresponding member. Here we present some ideas on open access to data and pose some questions for community feedback. We encourage the community to send us comments and suggestions as we deliberate this issue.

First of all, it is important to realize that GSA is not alone in recognizing the importance of this issue and that reports and statements on open data access from other sources exist. National Research Council reports include: "The Role of Scientific and Technical Data and Information in the Public Domain" (2003), "Geoscience Data and Collections: National Resources in Peril" (2002), "Resolving Conflicts Arising from the Privatization of Environmental Data" (2001), and "Bits of Power: Issues in Global Access to Scientific Data" (1997). The American Geophysical Union, the International Union of Geological Sciences, and International Council for Science all have statements on this issue. Other organizations that have developed similar policies include: U.S. Global Change Research Program, World Meteorological Organization, Intergovernmental Oceanographic Commission of UNESCO, World Climate Program, Committee on Earth Observation Satellites, International Earth Observing System, International Council for Science, and the Global Climate Observing System. Finally, the U.S. Geological Survey (USGS) and the American Association of State Geologists and some other federal and state agencies are trying to develop mechanisms to make their national and state-based data broadly available.

A GSA policy statement on access to data should be fairly simple. It should advocate the open access to the full spectra of scientific data, including derived products as well as basic data, and that obtained by private as well as public funding. All these data—physical and digital—should be readily avail-

able to the community. It must be recognized that building and maintaining open access to science data is a shared responsibility among all researchers, institutions, and state and national governments. One question, therefore, is whether we should explicitly name agencies and their roles, e.g., the USGS, Department of Energy, NSF.

The rapid advancement of cyberinfrastructure and geoinformatics demonstrates how critical the geoscience community feels about this issue. The technology is in place to build and promote a system that meets the needs of the science and its community, and continued advancement in computer science and information technology will further fuel this growing enterprise. It is suggested, therefore, that the policy statement should advocate the development of seamless links among digital databases and peer-reviewed publications. The needs of physical repositories are more difficult as it has been a challenge to find the fiscal support for them. Therefore, should efforts to save and archive physical samples in museums and university and agency repositories be specifically mentioned and supported? Should we explicitly encourage academic institutions to recognize fully the scholarship and scientific merit as well as the economic and societal value inherent in the development of geologic data sets and repositories, particularly as they evaluate individuals for tenure and promotion? The existing and emerging data policies of the NSF broadly support such open access, but stronger community support may contribute to strengthening their implementation. Should we explicitly cite these policies for NSF and other agencies?

Clearly, due to national security issues, commercial value of some data, and simply because of past practices, some data will not be made openly or at least freely available—should the statement recognize this? Should it suggest that, when some data are not initially made available to the public, it becomes so in a reasonable period of time? What about the cost of collecting, processing, validating, and submitting data to an archive (digital and physical)—should we advocate that these costs in time and money be considered an integral part of research and operational programs in research budgets and by the academic institutions? Finally, should we include geologic maps under this statement (keeping in mind that GSA has a separate statement already on the importance of maps)?

The background information and questions posed above underscore the overall community concern that open access to these geoscience data, which are international as well as national resources, should not only be maintained, but increased. Consequently, it is the panel's suggestion that GSA should support the preservation and enhancement of the open access to the full suite of science data and that this should be facilitated by laws, regulations, and policies of federal and state governments, and by public and private institutions. We encourage your comments and suggestions on this issue.

Integrated Solid Earth Sciences
 ISES Forum II
 Continental Lithosphere Rheology
 Sunday, December 12th, 2004

This year, on December 12, the day before the Fall Meeting of AGU in San Francisco, the ISES Coordinating Group will hold the second Integrated Solid Earth Science Forum (ISES Forum II) with the support of the NSF. This forum is another step in changing the research and education culture of the Solid Earth Sciences (SES) through communication and integration. We invite participation in the forum from individuals in all sectors of the Solid Earth Science community.

ISES Forum II will involve a series of updates and presentations concerning the ISES Initiative and EarthScope Program, and it will serve as a platform for ongoing discussion of the Solid Earth Science research agenda, this year with particular reference to continental lithosphere rheology. Community input through the Annual ISES Forums will be used to develop ISES initiatives to better integrate and strengthen our science. Several of the NSF EAR and OCE Directorate will attend the Forum, and will contribute to the discussion of opportunities available to the ISES community. Please come to San Francisco to meet with colleagues in the Solid Earth Sciences and the NSF, and be involved in developing the ISES community and in shaping our collective future.

To apply, send a single page two-paragraph application to Mike Brown at mbrown@geol.umd.edu as soon as possible. In the first paragraph, give your background, current interests and position, and summarize previous participation in recent workshops (e.g., "Setting Priorities in the Solid Earth Sciences", "New Departures in Structural Geology & Tectonics", "On the Cutting Edge", any "EarthScope" workshop), and in the second paragraph describe what you hope to contribute to ISES Forum II, including what you view as important priorities for the community and your ideas about the future direction of research and education in the Solid Earth Sciences. Please indicate the level of support you will need (generally as an add-on cost to your AGU attendance) to participate in the Forum (as a guide, we anticipate average grants for up to 100 participants of \$300-400 towards travel and/or hotel costs).



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Positions Open

TENURE-TRACK APPOINTMENT ENVIRONMENTAL GEOSCIENTIST/PALEOECOLOGIST FRANKLIN & MARSHALL COLLEGE

The Department of Earth and Environment at Franklin & Marshall College invites applications for a tenure-track position at the Assistant Professor level, beginning fall 2005. The Department offers majors in Geoscience, Environmental Science and Environmental Studies. The successful candidate will integrate his or her expertise into the interdisciplinary environmental science curriculum. Research interest in paleoecology and geobiology as they relate to climate change is particularly desirable. Teaching responsibilities will include introductory environmental geology, paleoecology/geobiology, global change, or geochemical cycles depending on the applicant's expertise, and a contribution to the College's general education program, "Foundations." For additional program information see our Web page at <http://www.fandm.edu/Departments/EnvironmentalScience/esp.html>. Applicants should have a Ph.D. and teaching experience. A commitment to undergraduate education, a strong program of scholarly research, and active engagement in a dynamic department are important. Send a letter of application, including a statement of teaching and research interests and a description of strengths you would bring to the Department, *curriculum vitae*, undergraduate and graduate transcripts, and three letters of recommendation to: Dr. Carol de Wet, Chair, Dept of Earth and Environment, Franklin Marshall College, Lancaster, PA 17604-3003 (carol.dewet@fandm.edu). Review of completed applications will begin December 1, 2004.

Franklin & Marshall College is a highly selective liberal arts college with a demonstrated commitment to cultural pluralism through the hiring of women and minorities. EOE/AA.

CASE WESTERN RESERVE UNIVERSITY

The Department of Geological Sciences at Case Western Reserve University (geology.case.edu) invites applications for one or more tenure-track appointments. Field and rank are open, but appointment at the rank of assistant professor is strongly preferred. We seek outstanding candidates who will complement existing strengths in geochemistry, surficial, environmental and sedimentary processes, planetary geology, and physics of the Earth's interior. Applicants are expected to develop a strong externally

funded research program, contribute to the Department's graduate program, interact with other departments and schools, and assist the Department in meeting College and University goals, including undergraduate teaching in the SAGES Program (www.case.edu/sages). The successful candidate will hold a Ph.D. or equivalent and have, relative to career stage, a distinguished record of publication, research, service, and teaching. Compensation will be commensurate with qualifications. Electronic applications consisting of a letter of application, statement of research and teaching interests, curriculum vitae, up to three reprints, and the names and contact information for four referees should be received by the Search Committee (geology_search@case.edu) by November 1, 2004, for best consideration. Case Western Reserve University is committed to diversity and is an affirmative action, equal opportunity employer. Applications from women and minorities are especially encouraged. Case has received an NSF ADVANCE grant to increase the participation of women in science and engineering.

TENURE-TRACK ASSISTANT PROFESSOR OF GEOLOGY UNIVERSITY OF NORTH ALABAMA

The University of North Alabama is accepting applications for the position of tenure-track Assistant Professor in the Department of Physics & Earth Science starting August 2005. Teaching responsibilities include an introductory earth science course and upper level courses including historical geology, paleontology, and sedimentology/stratigraphy. Experience and/or willingness to teach science education for pre-service teachers will be looked upon favorably. The successful candidate is expected to demonstrate excellence in teaching, develop and maintain an active program of research involving undergraduates, mentor student research, and participate in college service and student advising. The applicant is expected to have obtained a Ph.D. in geology by the time of appointment. Classroom teaching and field experience is desired. Send letter of interest, curriculum vitae, statement of research and teaching interests, graduate and undergraduate transcripts (official transcripts needed before hiring) and three letters of reference to Director of Human Resources and Affirmative Action, UNA Box 5043, University of North Alabama, Florence, AL 35632-0001. Review of applications will begin November 15, 2004, and remain open until the position is filled. Visit our web site at www2.una.edu/physics/. UNA is an equal opportunity employer committed to achieving excellence and strength through diversity.

UNA seeks a wide range of applicants for this position so that one of our core values, ethnic and cultural diversity, will be affirmed.

TWO TENURE-TRACK FACULTY POSITIONS UNIVERSITY OF THE PACIFIC

STRUCTURAL GEOLOGY AND HYDROGEOLOGY

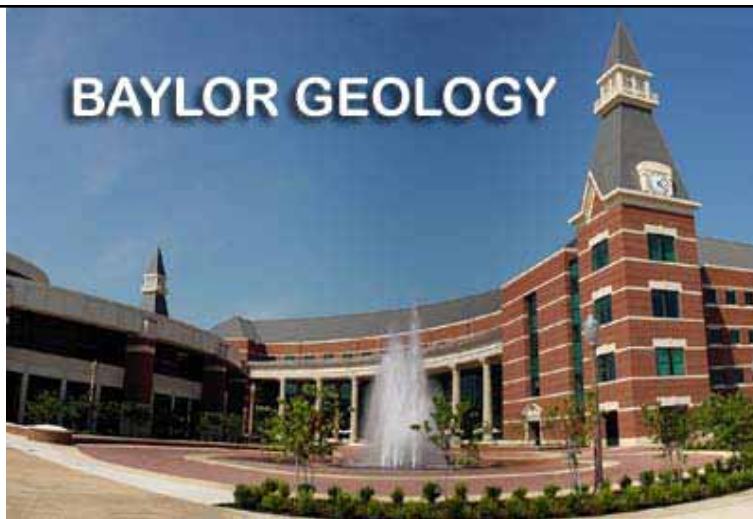
The Department of Geosciences at the University of the Pacific invites applications for two tenure-track positions. The first position is in the area of structural geology/neotectonics. The second position is in the area of hydrogeology. The successful candidates will be expected to (1) have a strong commitment to undergraduate education, (2) teach introductory geosciences/environmental science courses as well as upper level courses in their area of expertise, (3) contribute actively to a new environmental science major to be housed in the department, (4) develop an active research program that includes undergraduates, and (5) participate in the university general education/freshman seminar program. Preference will be given to candidates with experience and ability to teach in one or more of the following areas: GIS, field geology, soils, geophysics, and local/regional environmental issues. Applicants should send a letter of interest, CV, statement of teaching philosophy and research plans, names and full contact information of three references to: Lydia K. Fox, Chair, Department of Geosciences, University of the Pacific, 3601 Pacific Avenue, Stockton, CA 95211 (email: lkfox@pacific.edu). See <http://www1.uop.edu/cop/geology> for more information. The University of the Pacific is an equal opportunity/affirmative action employer encouraging excellence through diversity.

UNIVERSITY OF WEST FLORIDA ASSISTANT PROFESSOR, HYDROGEOLOGY

The Department of Environmental Studies, University of West Florida, invites applications for a tenure-track assistant professor position in hydrogeology beginning August 2005.

We seek candidates with expertise in applied groundwater hydrology or water/land surface interactions. Interest in environmental issues is highly desirable. Candidates will be expected to teach both lower and upper-division classes in geology and hydrology, and graduate courses in their field of specialization.

Applicants are expected to develop an active research program and should be committed to peer-reviewed publication. They should demonstrate evidence of, or potential for, excellent teaching skills. A Ph.D. in geology or related



Our new facilities provide excellent research opportunities in the geosciences and demonstrate Baylor's commitment to increased research scholarship. We are seeking interested graduate and undergraduate students to join our department. We currently have 13 faculty members, and anticipate future expansion with the addition of new faculty. Areas of emphasis are sedimentology, paleopedology, petroleum geology, paleontology, hydrogeology, hydrology, low temperature geochemistry, engineering geology, volcanology, geophysics, structural geology, and physical geography/GIS. Contact: Steven_Driese@baylor.edu (chair), 254-710-2361.

For more information, please visit our **Booth #218** in the exhibits area at the **2004 GSA Annual Meeting** in Denver or see our web site:

<http://www.baylor.edu/Geology/>

discipline is required at the time of appointment. Salary is commensurate with qualifications and experience.

The Department of Environmental Studies offers B.S. and M.S. degrees in Environmental Science and a Certificate in Geographic Information Science. Over 120 undergraduate majors specialize in tracks in natural science, environmental policy, and geography. The department is housed in a renovated building with new research and teaching facilities. The department maintains the university-wide GeoData Center, which has extensive GIS capabilities. Personnel include 7 full-time faculty, several adjunct faculty, and a GIS Coordinator. For more information on the department see <http://uwf.edu/environmental/>.

Apply at <http://jobs.uwf.edu>. Candidates are requested to attach to the electronic application a statement of research and teaching interests and experience, and a curriculum vitae. Official transcripts and three sealed letters of reference should be sent to Dr. Johan Liebens, Department of Environmental Studies, University of West Florida, 11000 University Parkway, Pensacola, FL 32514.

For information, contact Dr. J. Liebens at phone (850)474-2065, fax (850)857-6036, or email liebens@uwf.edu. Review of applications will begin November 15, 2004, and will continue until the position is filled.

The University of West Florida is an Equal Opportunity/Access/Affirmative Action Employer. A police background screening is required.

**SEISMOLOGY/PNSN DIRECTOR
UNIVERSITY OF WASHINGTON**

The Dept. of Earth and Space Sciences at the University of Washington is seeking candidates for a tenured faculty position in the field of seismology to act as Director of the Pacific Northwest Seismograph Network (PNSN). The appointment is expected to be filled at the rank of Associate or full Professor. Applicants must hold a Ph.D. in Geophysics or a closely related field.

The successful applicant should have experience managing seismic networks or large seismic experiments and a publication record of innovative seismological research.

Primary duties: To provide vision and leadership to the PNSN, develop emerging opportunities related to ANSS, EarthScope, and NEPTUNE, and manage the PNSN staff who are responsible for the day to day operations of the PNSN. The successful candidate will be expected to maintain a vigorous, externally funded research program and demonstrate a commitment to both undergraduate and graduate teaching. Teaching duties will be at a lighter load than normal to compensate for PNSN directorship duties.

Applicants should send a curriculum vita, bibliography, a statement of teaching and research interests and experience, and the names of four references to: PNSN Search Committee, c/o D. Ellen McDannald, Department of Earth and Space Sciences, University of Washington, Box 351310, Seattle, WA 98195-1310. Priority will be given to applications received before October 31, 2004.

The University of Washington is an affirmative action, equal opportunity employer. The University is dedicated to the goal of building a culturally diverse and pluralistic faculty and staff committed to teaching and working in a multicultural environment and strongly encourages applications from women, minorities, individuals with disabilities and covered veterans.

**ASSISTANT PROFESSOR OF HYDROGEOLOGY
HAMPSHIRE COLLEGE**

Hampshire College is seeking an earth scientist for a full-time Assistant Professor position in water geoscience and hydrogeology, with interests in water resource management. A Ph.D. is required.

We seek an accomplished, energetic scientist whose innovative teaching engages undergraduates in genuine research. Candidates' abilities to combine undergraduate teaching and research in exciting ways will be weighed more heavily than their specific disciplines. We seek an active participant in our Women in Science Program and an individual who will take a leadership role in promoting diversity in the sciences. The successful applicant will complement our existing strengths in earth and environmental science, sustainable technology, ecology, and agriculture. See our program description at <http://ns.hampshire.edu/>.

Hampshire College, an independent liberal arts college, offers a stimulating and supportive environment for interdisciplinary teaching and collaborative research. We emphasize discussion, projects, and written evaluations rather than lectures, exams, and grades. We seek scientists whose innovative teaching engages students in genuine research at the introductory and advanced levels. Applicants should discuss their ideas for integrating research and teaching in their application letter. Hampshire College is a member of the Five College consortium which offers extensive possibilities for research collaboration.

Application review begins September 15, 2004, for a position starting July 1, 2005. Please send a letter

of application, vitae, descriptions of courses, ideas for research and interdisciplinary collaboration, and three letters of reference to: Laurie Smith, Assistant Professor of Hydrogeology Search, School of Natural Science, Hampshire College, Amherst, MA 01002.

Affirmative Action/Equal Opportunity Employer. hr.hampshire.edu.

**O.K. EARL AND TEXACO
POSTDOCTORAL FELLOWSHIPS
CALIFORNIA INSTITUTE OF TECHNOLOGY**

The California Institute of Technology announces two fellowships in Geological and Planetary Sciences. The O.K. Earl and Texaco Postdoctoral Fellowships are awards funded by endowments from Orrin K. Earl, Jr., and the Texaco Philanthropic Foundation. Each fellowship carries an annual stipend of \$46,000 plus a research expense fund of \$2,000 per year and one-way travel costs to Pasadena. The duration of each appointment is normally two years, contingent upon completion of the Ph.D. degree and good progress in the first year, beginning with the 2005-06 fall term. Fellows are eligible to participate in Caltech's health and dental program.

These fellowships have been established to support the research of scientists typically within two years after receipt of the Ph.D. The intent of the program is to identify and support innovative and creative work in the earth and planetary sciences, with particular emphasis on interdisciplinary work. Applicants with training in physics, chemistry, biology, or computer sciences are urged to apply. The Division is currently active in geobiology, geochemistry, geology, geophysics, petrology, seismology, environmental science and engineering, and atmospheric and planetary sciences. It is expected that each fellowship recipient will be hosted by a division professor (designated by the Chairman) who will provide both financial support and intellectual guidance.

Materials in support of an application should include a curriculum vitae, list of publications, and a one-page statement of research interests. The candidate should also request that three letters of reference be sent directly to the Chairman, Division of Geological and Planetary Sciences, MC 170-25, California Institute of Technology, Pasadena, CA 91125, Attention: Prize Postdoctoral Fellowships. For convenience, applications and references may be sent to: chairman@gps.caltech.edu. All applications and references are due by Friday, December 17, 2004.

Fellowship candidates will automatically be considered for other available postdoctoral positions at Caltech in their fields of interest.

Caltech is an Affirmative Action/Equal Opportunity Employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

**DEPARTMENT OF GEOLOGY
UNIVERSITY OF MARYLAND, COLLEGE PARK**

The Department of Geology at UMD is searching for outstanding scientists as faculty colleagues in the broadly-defined areas of mineralogy (with any specialty from mineral chemistry to mineral physics), and geomicrobiology/biogeosciences. A Ph.D. is required at the time of appointment and the starting date is flexible. The Department anticipates filling several positions, with the possibility of at least one hire at a senior rank. Salary will be commensurate with experience. The appointee is expected to develop and maintain an active, externally funded research program that will involve both graduate and undergraduate students, and to participate fully in teaching at the graduate and undergraduate levels, including introductory courses at the freshman level. We particularly seek applicants who will interact with and complement existing research programs, both in the Department and more widely in the College and across the Campus; additionally, the Department encourages interdisciplinary approaches to the study of the Earth and participates in the Earth System Science Interdisciplinary Center.

The University of Maryland is an affirmative action/equal employment opportunity employer. For best consideration, applications should be submitted by December 1, 2004, preferably electronically, and should be submitted to: Chair, Search Committee, Department of Geology, University of Maryland, College Park, MD 20742, USA (at geo-apply@umd.edu). Applicants should provide a statement describing research and teaching interests, indicating how s/he envisions contributing to the Department's research and teaching activities, current curriculum vitae and names and addresses of at least four referees. Applicants should ask a minimum of two of these nominated referees to send letters directly to the Chair of the Search Committee as soon as possible (via geo-apply@umd.edu).

**POMONA COLLEGE
FACULTY POSITION IN PETROLOGY/MINERALOGY**
The Geology Department at Pomona College, the founding



**STRUCTURAL
GEOLOGIST**

The Department of Geology at Temple University invites applications for a temporary (up to three years) position in Structural Geology to begin in Fall 2005. Ph.D. is required. The successful candidate will be expected to conduct field and laboratory-based research that incorporates graduate (Master's) and undergraduate students. While the area of expertise within structural geology is open, we expect the candidate to complement one or more of our existing strengths in hydrogeology, sedimentology and stratigraphy, environmental geophysics, geochemistry, and mineralogy/petrology. In addition to research, the candidate is expected to teach graduate and upper level undergraduate courses in structural geology, as well as introductory geology courses. Available resources include a thin section laboratory, an inductively coupled plasma-mass spectrometer, and x-ray diffraction facilities. The deadline for applications is December 17, 2004. Applications should include a statement of teaching and research goals, CV, copies of selected reprints, names and addresses of at least three references, and transcripts. Application materials should be sent to **Chair, Search Committee, Department of Geology, 303 Beury Hall, Temple University, Philadelphia, PA 19122**. Temple University is an equal opportunity employer.

member of the Claremont Colleges, invites applications for a tenure-track position at the level of Assistant Professor beginning July 1, 2005. Candidates with significant teaching experience are encouraged to apply. We seek a colleague with a strong and enthusiastic commitment to providing a quality undergraduate education in a liberal arts environment and to establishing an active research program involving undergraduates. Teaching responsibilities are expected to include mineralogy, igneous/metamorphic petrology, introductory and specialty courses. We seek a colleague who applies integrative field and lab based approaches to petrologic problems—the ideal candidate will have a research direction which diversifies our existing research programs. Applicants should send a letter of interest, curriculum vitae, undergraduate and graduate transcripts, a statement of teaching philosophy, a summary of research plans and three letters of reference to Pet-Min Search, Geology Department, Pomona College, Claremont, CA 91711. Web address: <http://www.geology.pomona.edu>; email: GeoFacSearch@pomona.edu. Review of completed applications will begin November 24, 2004, and will continue until the position is filled. Pomona College is an equal opportunity employer, and it especially invites applications from women and members of under-represented groups.

**U.S. GEOLOGICAL SURVEY
MENDENHALL POSTDOCTORAL RESEARCH
FELLOWSHIP PROGRAM**

The U.S. Geological Survey (USGS) invites applications for the Mendenhall Postdoctoral Research Fellowship Program for Fiscal Year 2006. The Mendenhall Program provides opportunities to conduct research in association with selected members of the USGS professional staff. Through this Program the USGS will acquire current expertise in science to assist in implementation of the science strategy of its programs. Fiscal Year 2006 begins in October 2005.

Opportunities for research are available in a wide range of topics. The postdoctoral fellowships are 2-year appointments. The closing date for applications is December 1, 2004. Appointments will start October 2005 or later, depending on availability of funds. A description of the program, research opportunities, and the application pro-



Grant, Urban-Grant and Space-Grant institution with its main campus in Newark, DE, located halfway between Washington, DC and New York City. **Please visit our website at www.udel.edu.**

One of the oldest institutions of higher education in this country, the University of Delaware today combines tradition and innovation, offering students a rich heritage along with the latest in instructional and research technology. The University of Delaware is a Land-Grant, Sea-

Assistant Professor of Soil and Land Resources

The Department of Plant and Soil Sciences invites applications for a nine month tenure track faculty position at the Assistant Professor level in the area of Soil and Land Resource Science with an emphasis in Pedology/Mineralogy, available January, 2005. Responsibilities will be divided between research (80%) and teaching (20%). The successful applicant will develop a nationally recognized research program supported by extramural funding and participate in teaching at the undergraduate and graduate levels. The candidate will complement existing soils research within the Department by providing expertise in the areas of pedology, mineralogy, and land use management of soil-landscape complexes, particularly as related to environmentally important issues such as water quality, wetland management, land application of wastes, and remediation of contaminated soils. Expertise in applying geospatial tools to these problems is expected. In addition, the individual will teach one course per year, alternating between an undergraduate/graduate course in Pedology and a graduate course in his/her area of expertise. Teaching and research facilities are located at the University of Delaware, Newark, DE. Participation in the Institute of Soil and Environmental Quality (<http://ag.udel.edu/iseq/>) is possible. **REQUIREMENTS:** Ph.D. in soil science or closely related field of geoscience with expertise in pedology (soil genesis, morphology, and classification), soil mineralogy, and land use management. Other desirable areas of expertise include geographic information systems, geomorphology, soil hydrology, and soil conservation. Postdoctoral experience is desirable. Willingness and ability to contribute effectively to collaborative research efforts is essential. **SALARY:** Commensurate with experience and training. The University of Delaware provides an excellent employee benefits package including health and dental insurance, retirement contributions (TIAA/CREF), pre-tax flexible spending accounts, and tuition remission for eligible family members. **CONTACT:** Submit letter of application, curriculum vitae, one page statement of research and teaching interests, names, email and addresses, and telephone numbers of three references, and a list of relevant courses by October 15, 2004 to: Yan Jin, Search Committee Chair, Department of Plant and Soil Sciences, 152 Townsend Hall, University of Delaware, Newark, DE, 19716. Contact information: phone 302-831-6962; fax 302-831-0605; e-mail yjin@udel.edu. The curriculum vitae and letters of reference shall be shared with departmental faculty.

The UNIVERSITY OF DELAWARE is an Equal Opportunity Employer which encourages applications from Minority Group Members and Women.

cess are available at <http://geology.usgs.gov/postdoc>. The U.S. Geological Survey is an equal opportunity employer.

DENISON UNIVERSITY VISITING ASSISTANT PROFESSOR PHYSICAL GEOLOGY

The Department of Geology and Geography at Denison University invites applications for a 3-semester appointment at the visiting assistant professor level, to begin in January 2005 and continue through the 2005-2006 academic year. Primary teaching responsibilities will be introductory courses in geology, with the opportunity to teach upper level courses in hydrogeology, environmental geology, or others depending on the candidate's interests and areas of expertise. The minimum requirement is an ABD; a Ph.D. is desirable. Our department stresses a balance of classroom, field and laboratory experiences for our majors, and we seek a colleague who will contribute to all of these components of our undergraduate curriculum. Denison is a selective liberal arts college strongly committed to and supportive of excellence in teaching and active faculty research that involves undergraduate students.

Please submit a letter of application and a discussion of your approach to teaching and research in a liberal arts setting, along with a vitae, academic transcripts, and contact information for three references to: David C. Greene, Department of Geology and Geography, Denison University, Granville OH 43023; (740) 587-6476; greened@denison.edu. Application materials must arrive by October 8, 2004, for full consideration. Interviews will be conducted at the GSA meeting in Denver. Denison is an affirmative action/equal opportunity employer. Women and minorities are encouraged to apply.

TENURE-TRACK PROFESSORSHIP IN SEDIMENTOLOGICAL AND STRATIGRAPHIC APPROACHES TO EARTH SYSTEM HISTORY AND DYNAMICS SAN DIEGO STATE UNIVERSITY

The Department of Geological Sciences at San Diego State University invites applications for a tenure-track Assistant Professorship starting in fall 2005. Applicants should employ novel approaches that address fundamental questions on the history and dynamics of the Earth system using techniques drawn from sedimentology, stratigraphy, and related disciplines. We are particularly interested in applicants that build upon our established research programs in paleobiology, paleoecology, paleoceanography, Quaternary geology, isotope geochemistry,

geohydrology, and tectonics. Applicants are expected to develop an integrated research and education program that fosters excellence at the undergraduate and graduate levels; teaching expectations include undergraduate non-major/major courses and graduate courses in the applicant's field of expertise.

Applicants should post-mail a letter describing their experiences and interests in research and teaching, a curriculum vitae, and contact information for three references to Dr. Stephen A. Schellenberg, Search Committee Chair, Department of Geological Sciences, San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-1020. References should post-mail their letters directly to the search committee chair. Closing date for receipt of applicant and reference materials is 1 November 04 and a Ph.D. is required at time of appointment. SDSU is a Title IX, equal opportunity employer and does not discriminate against individuals on the basis of race, religion, national origin, sexual orientation, gender, marital status, age, disability or veteran status, including veterans of the Vietnam era. Learn more about our department at www.geology.sdsu.edu and our university at www.sdsu.edu.

FACULTY POSITION REMOTE SENSING OR VOLCANOLOGICAL GEOHAZARDS GEOSCIENTIST UNIVERSITY AT BUFFALO

The Department of Geology at the University at Buffalo, a Research I University, invites applications for a tenure-track faculty position. We seek a specialist in either remote-sensing or volcanological geohazards, starting in August 2005 at the rank of Assistant Professor. The successful candidate will demonstrate a potential for research and teaching that will complement and integrate with our existing programs in volcanology and environmental geology. Existing research in the department includes studies of geohazards, volcanology, planetary geology, surficial processes, neotectonics, fractured rock systems, ground water, and basin analysis, including oil and gas exploration. The successful candidate may also wish to collaborate with the National Center for Geographic Information and Analysis and the Center for Computational Research at the University at Buffalo. Teaching duties will involve undergraduate and graduate level courses in the candidate's specialties. Successful candidates must have a Ph.D. degree at the time of appointment. Apply with a statement of teaching and research goals and a curriculum vitae, including published research, grant support, and names of at least three references to: Chair, Search

Committee, Department of Geology, 876 Natural Science Complex, University at Buffalo, The State University of New York, Buffalo, NY 14260-3050. More information about our department can be found at: <http://www.geology.buffalo.edu>. We will begin evaluating applicants November 1, 2004. Posting No. F-4039. The University at Buffalo is an Equal Opportunity Employer/Recruiter.

ASSISTANT PROFESSOR IN WATER RESOURCES SUNY ONEONTA

The College at Oneonta invites applications for a full-time tenure track position for an Assistant Professor in Water Resources. The expectations include instruction, research, student advisement, college service and continuing professional development. Start date is Fall 2005. The initial appointment is for two years. SUNY Oneonta is a liberal arts college within the SUNY system, with an enrollment of 5700 students. The college is located in the western Catskill mountains, about one hour from the state capital. The nine-member Earth Sciences Department is multi-disciplinary with undergraduate degree programs in water resources, geology, earth science, earth science education, environmental earth science, and meteorology. There is also a small master's degree program in geology with an optional concentration in hydrogeology. For additional information, see the College's home page at <http://www.oneonta.edu>. Duties: Teach undergraduate and graduate-level courses in hydrogeology; advise undergraduate students majoring in water resources; advise graduate students and supervise thesis research. Required Qualifications: Ph.D. in hydrogeology, hydrology, geology, or related fields; must have strong background in quantitative groundwater hydrology, aqueous geochemistry, and computer applications; interest in teaching in an undergraduate program is important. Preferred: Orientation toward field applications, knowledge of field geophysics and/or watershed hydrology. To Apply: Send letter of application, resume, official graduate transcripts, and have three professional references send letters to: Dr. Arthur Palmer, Chair, Search Committee, Earth Sciences Department, 212 Science Building I, Box GSA, #1030-C, SUNY Oneonta, Oneonta, NY 13820-4015. SUNY Oneonta is an EEO/AA/ADA employer.

FACULTY POSITION/GEOLOGY MARSHALL UNIVERSITY

Marshall University seeks applications for a tenure track appointment as Assistant or Associate Professor of Geology beginning August 15, 2005. The successful applicant will teach advanced courses in Mineralogy, Petrology, and Geochemistry and General Geology and Earth Materials Lab. An earned doctorate in Geology is required and several years of post secondary teaching experience is preferred. A vigorous, externally supported program of undergraduate research is expected and a research focus on environmental geochemistry is highly desirable. Department resources include an extensive rock and mineral collection, thin and polished section preparation lab, X-ray Diffractometer, ICP and AA Spectrometer, and SEM with EDS.

Candidates must submit a letter of application, curriculum vitae, undergraduate and graduate transcripts, a statement of teaching and research interests, and the names and contact information (including e-mail addresses) for three references to Prof Ronald Martino, Department of Geology, Marshall University, Huntington, WV 25755. Review of applications will begin in November continue until the position is filled.

Marshall University is an EO/AA employer. Women and minorities are encouraged to apply. For additional information about the Department of Geology and Marshall University, please visit the website www.marshall.edu.

WELL LOGGING PETROPHYSICIST AND GEOPHYSICIST PETROLEUM INSTITUTE, ABU DHABI

The Petroleum Geosciences Program of The Petroleum Institute, Abu Dhabi, is seeking outstanding candidates for positions in well logging-petrophysics and possibly reflection seismology geophysics, although other specializations will be considered. An appointment is desired in January, 2005.

Applicants should possess a Ph.D. in Geology or Geophysics, although outstanding candidates with a M.Sc. will be considered for the well logging-petrophysics position. Experience in the petroleum industry is desirable. Appointments will be at a rank commensurate with experience. Faculty in Petroleum Geosciences will teach undergraduate and graduate courses, develop an active research program that impacts the UAE petroleum industry, and engage in institutional service work. Opportunities exist to work with PI industry stakeholders in research.

The Petroleum Institute is a small, highly focused, teaching and research institute that offers educational programs that will lead to B.Sc., M.Sc., and Ph.D. degrees in engineering and petroleum geosciences. Staff will have

the resources to equip laboratories with up-to-date analytical equipment and computer software and hardware to support teaching and research.

The compensation package for staff includes housing, utilities, home furnishings loan, automobile purchase loan, and annual leave travel.

This is an unusual opportunity for self-motivated geoscientists to help build a world-class teaching and research institution. Additional information is at www.pi.ac.ae/. Interested candidates should send a letter of application and their résumé electronically to rwinn@pi.ac.ae with a copy to mkassim@pi.ac.ae. Please submit a hardcopy application only if unable to submit electronically to: Faculty Recruitment Coordinator-Petroleum Geosciences Program, Petroleum Institute, P.O. Box 2533, Abu Dhabi, United Arab Emirates.

Candidates are encouraged to submit an application as soon as possible and no later than 31 September 2004, although applications will be considered until vacant positions are filled.

**TENURE TRACK POSITION IN
SEDIMENTARY GEOLOGY
TEXAS TECH UNIVERSITY**

The Department of Geosciences at Texas Tech University invites applications for a tenure track position in sedimentary geology to begin in Fall 2005. The position will be filled at the assistant professor level; a Ph.D. in geological sciences is required at the time of appointment.

We seek a person with research and teaching interests in sedimentology, sedimentary petrography, and/or sequence stratigraphy to establish an innovative, externally funded academic research program that includes practical applications to hydrocarbon exploration and production. The candidate will be expected to develop upper division and graduate courses in their specialty, direct M.S. and Ph.D. student research, and assist with freshman geology courses. A working knowledge of interpretative and computation tools used in hydrocarbon exploration and production is preferred. Opportunities exist for participation in programs with petroleum engineering and civil engineering (hydrology).

Review of applicants will begin on December 1, 2004. Applicants should submit a letter of application, a description of teaching philosophy and research objectives, curriculum vitae, and names and contact information, including e-mail addresses, of at least three professionals who will write letters of recommendation. Applications should be sent to the search committee: Geology Search Committee, Department of Geosciences, MS 1053, Texas Tech University, Lubbock, TX 79409-1053. Representatives of the Department will be present at the GSA Annual Meeting in Denver.

Our web site (www.gesc.ttu.edu) describes the laboratories, facilities and current research programs in the Department, and guidelines for promotion and tenure. The Department houses equipment for stable isotope analysis, x-ray diffraction, and ICP elemental analysis, TEM and SEM, and a thin-section preparation facility with technician. Geologic interpretational/modeling software packages such as Geographix Discovery, SMT Kingdom Suite, and GoCAD, as well as GIS packages, are available in the computer labs of the department. Funding for additional analytical and computational tools is being sought.

Texas Tech University is an equal opportunity/affirmative action institution.

**FURMAN UNIVERSITY, TENURE-TRACK POSITION:
SURFACE AND GROUND WATER GEOLOGY**

The department of Earth and Environmental Sciences at Furman University invites applications for a tenure-track position at the assistant professor level for the fall of 2005.

The required qualifications are a Ph.D. in geology and a specialty in watershed processes from a sediment transport, environmental, and hydrology perspective. Interests in environmental law and policy and/or GIS would be beneficial. Teaching duties would include a basic earth systems course, surface and ground water courses, and an advanced course in area of expertise. The successful candidate would be expected to excel in teaching and to develop a strong research program involving talented undergraduates.

The department currently consists of four faculty with specializations in GIS/remote sensing, biogeochemistry, structure and tectonics, and mineralogy and petrology. Furman University is a private liberal arts university with a strong emphasis on undergraduate research and teaching. Furman's location in the Piedmont region of South Carolina at the base of the Blue Ridge escarpment provides many opportunities for field trips and research in fluvial processes, ground and surface water hydrology, and the impact of urban sprawl.

Applicants should send a vita including experience, publications, statement of teaching philosophy and research interests, and names of three references.



The American Geological Institute, a non-profit federation of 43 geoscience societies, is seeking a Director of Government Affairs. This position is responsible for all phases of AGI's government affairs program, working actively with Member Societies, Congress, and federal agencies to bring accurate science into the decision-making process of public policy; serve as a focused voice for the shared policy interests of the geoscience profession; monitor and analyze legislation and policy developments affecting the geosciences; and develop AGI congressional testimony and policy positions on national geoscience issues.

Candidates should have an advanced degree in the geosciences, with a Ph.D. preferred as well as a demonstrated experience in science and public policy. Demonstrated outstanding written, verbal, and management skills are required. A strong familiarity with the geoscience community through active society participation is desired.

Candidates should submit a resume, including salary requirements and the names of three references, with cover letter to Government Affairs Director Search, AGI, 4220 King Street, Alexandria VA 22302-1502 or jobs@agiweb.org. For more information on the program, see <http://www.agiweb.org/gap>. Applications will be considered on a continuous basis until the position is filled. EOE.

Applicants should discuss how they would include undergraduates in their research.

More information about the department can be obtained from <http://ees.furman.edu>. Applications should be sent to Kenneth A. Sargent, Dept. of Earth and Environmental Sciences, Furman University, Greenville, SC 29613 or e-mailed to ken.sargent@furman.edu. Furman University is an equal opportunity, affirmative action employer.

**FLINT POSTDOCTORAL FELLOWSHIP
AT YALE UNIVERSITY
FOR THE STUDY OF GLACIAL AND
CLIMATIC HISTORY AND PROCESSES**

The Department of Geology and Geophysics announces a competition for the Flint Postdoctoral Fellowship. This fellowship is awarded for two years, and provides a stipend (\$40,000/yr), health care benefits, and funds (\$2,000/yr) for research and travel.

The Flint Fellowship is intended to advance the understanding of climatic processes as well as Cenozoic climatic history. Specific research areas include, but are not limited to, glaciology; climatology; atmospheric circulation; low-temperature geochemistry; coupling between tectonics, climate and surface processes; and the biologic record of climate change.

Applicants should submit a curriculum vita; list of publications; names, addresses and email-addresses for three referees; and a short proposal outlining research objectives while at Yale. The application deadline is November 15, 2004. Successful applicants will start their program at Yale between January 1, 2005, and January 1, 2006.

All application materials should be sent to: Flint Postdoctoral Fellowship, Department of Geology and Geophysics, P.O. Box 208109, Yale University, New Haven, CT 06520-8109. FAX: +1-203-432-3134. Contact Professor Karl Turekian or Ronald Smith for questions regarding the fellowship.

**ENVIRONMENTAL AND EARTH SCIENCE
WILLAMETTE UNIVERSITY**

Tenure track, Assistant Professor, Ph.D. required. Broadly trained earth scientist; teaching responsibilities include introductory physical geology, environmental geology, and upper level courses in any of the following areas: oceanography, geomorphology, hydrology or Geographic Information Systems. The successful candidate will also

contribute to the senior seminar and supervise theses, teach general education and interdisciplinary courses, as well as provide collaborative research opportunities for students as part of the Science Collaborative Research Program. Send letter expressing how your teaching/research philosophy contributes to a liberal arts education, CV, transcripts, evidence of teaching effectiveness, and 3 letters of reference to Karen Arabas, Environmental Science Search Committee Chair, Environmental and Earth Sciences Department, Willamette University, 900 State St., Salem, OR 97301. Review of applications begins Nov. 1, 2004, and continues until the position is filled. Willamette maintains a strong institutional commitment to diversity and strives to recruit and retain candidates from communities of color and ethnic groups.

**BIOGEOSCIENCE OR PALEONTOLOGY
UNIVERSITY OF OREGON**

The Department of Geological Sciences at the University of Oregon invites applications for an entry-level, tenure-track position to begin in fall 2005. We seek a researcher with interests in fundamental problems in paleontology or biogeoscience, including the origin and evolution of life, geomicrobiology, evolutionary radiations, biogeochemistry, mass extinctions, geochemical cycles and environmental change, or life in extreme environments. Our interests are broad and range from microbial biogeoscience to vertebrate paleontology.

The successful applicant will be expected to develop a vigorous, academically oriented, externally funded, research program, and to contribute to teaching at the introductory, upper division, and graduate levels. Completion of the Ph.D. is required and postdoctoral experience is desirable.

Applicants should send a curriculum vitae, statement of teaching and research interests, and contact information for at least three referees to Biogeoscience Search Committee, Department of Geological Sciences, 1272 University of Oregon, Eugene, OR 97403-1272. We will begin reviewing applications November 1, 2004, and will continue until the position is filled.

The University of Oregon is an equal opportunity/affirmative action institution committed to cultural diversity and compliance with the Americans with Disabilities Act. Women and minorities are especially encouraged to apply.

Books—New Releases

COASTAL GEOLOGY, NC Sea Grant: *Drowning the North Carolina Coast: Sea-Level Rise and Estuarine Dynamics* by S. Riggs & D. Ames, 152 pgs, full-color photos & maps, \$25. *The Soundfront Series*, ideal for property owners, resource managers; \$20/4-guide set. *The Dune Book*, by S. Rogers & D. Nash, Award-winning! \$5. Bulk order discounts. 919/515-9101, www.nseagrant.org.

DISSENSIONS, by George D. Klein. Fictional account of surviving intrigue in academe and winning at the highest level. \$19.54 (softcover—ISBN: 1-4134-4210-2), \$29.69 (hardcover—ISBN: 1-4134-4211-0), plus S & H. Xlibris. 1-888-795-4275. <http://www1.xlibris.com/bookstore/bookdisplay.asp?bookid=22528>.

Books—Used & Rare

Recent, Rare, and Out-of-print Books. Find our catalogs at <http://booksgeology.com> for books on geoscience, paleontology, mineralogy, mining history, ore deposits, USGS publications, petroleum, remote sensing and metallurgy. E-mail: msbooks@booksgeology.com. We purchase books and entire collections. MS Book and Mineral Company, P.O. Box 6774, Lake Charles, LA 70606-6774 USA

Consultants

Soil Tectonics. Soil dating and paleoseismology to enhance your project. 510-654-1619, gborchardt@usa.net, www.soiltectonics.com.

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Editing Services

Mary C. Eberle, B.A., M.S., contract editor for the Geological Society of America and other geological outfits, invites you to inquire about her editing services. She can distinguish "early" from "lower" and "basal" from "basite." Clarity and consistency are her goals. www.wordrite.com.

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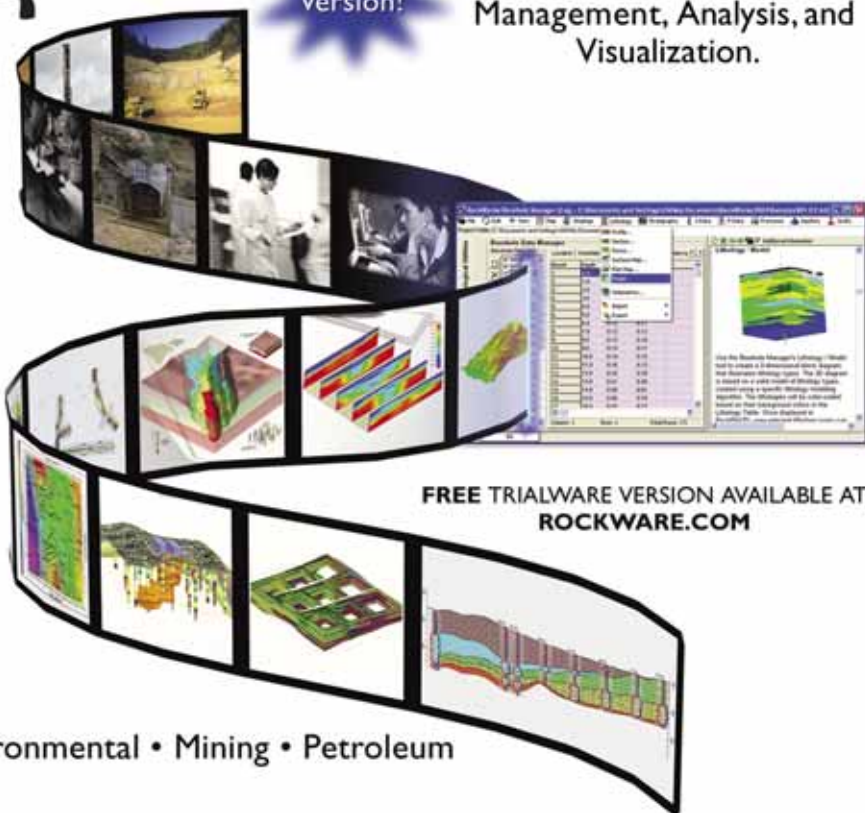
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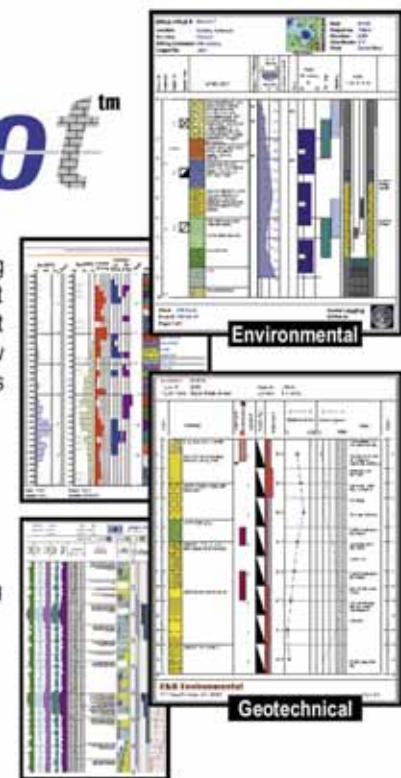
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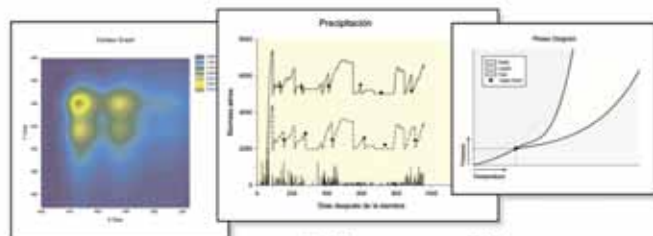


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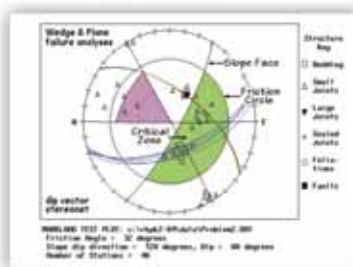
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