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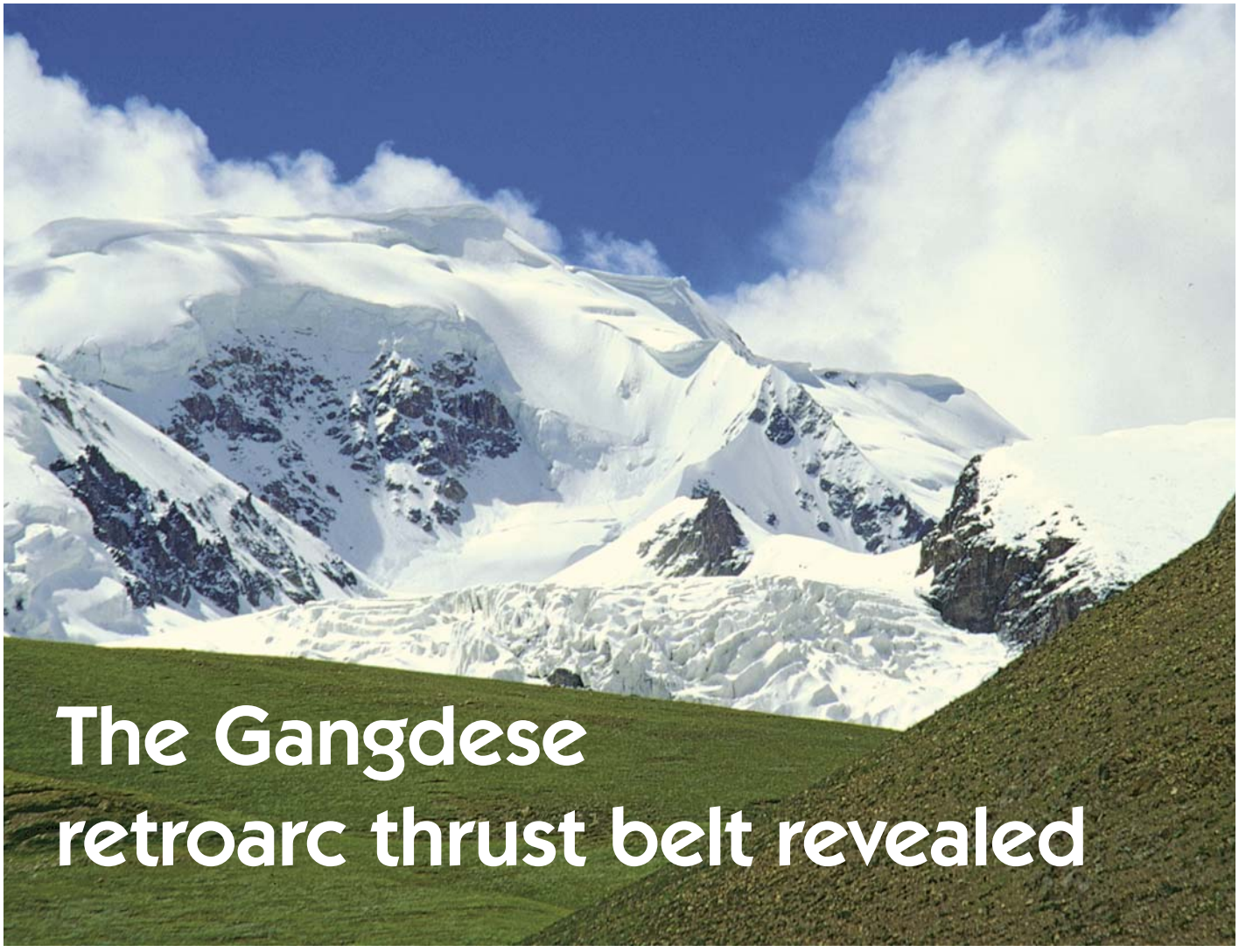

The Gangdese retroarc thrust belt revealed

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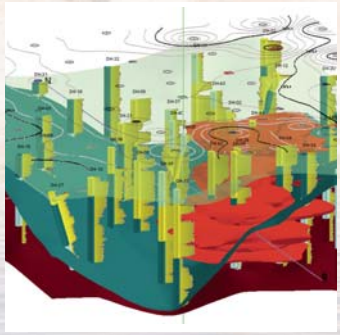

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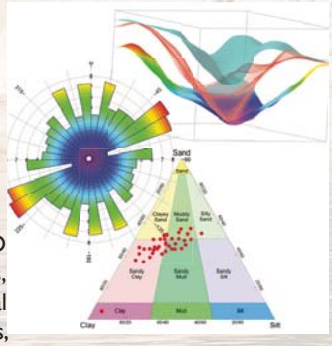

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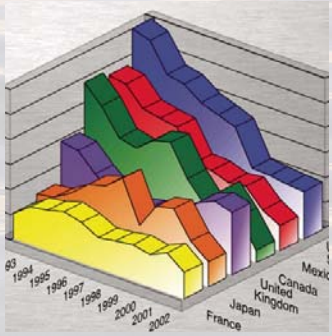

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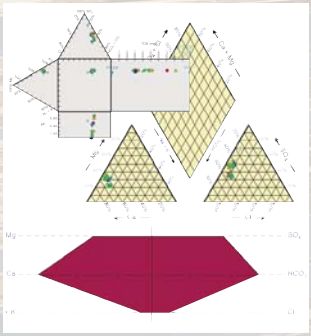

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Cover: North-south–trending ranges bounding active rifts in the Lhasa terrane of southern Tibet provide spectacular cross-sectional exposures of older, east-west–striking thrust belts. This photo looks toward the west at the Xiagangjiang Range in a remote part of the north-central Lhasa terrane. Recent studies suggest that the thrust belts accommodated large-magnitude shortening (≥50%) during Late Cretaceous to early Eocene northward subduction of Neotethyan oceanic lithosphere beneath the southern margin of Asia. This in turn implies that southern Tibet underwent significant crustal thickening and elevation gain prior to the Indo-Asian collision. Photo by Paul Kapp. See "The Gangdese retroarc thrust belt revealed" by Kapp et al., p. 4–9.

SCIENCE ARTICLE

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The Gangdese retroarc thrust belt revealed

P. Kapp*, P.G. DeCelles, A.L. Leier*, J.M. Fabijanic*, S. He, A. Pullen, G.E. Gehrels, *Department of Geosciences, University of Arizona, Tucson, Arizona 85721, USA; and* ***L. Ding,*** *Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing 100029, China*

ABSTRACT

The Cretaceous–early Tertiary Gangdese arc in southern Tibet is generally attributed to the northward subduction of Neotethyan oceanic lithosphere prior to Indo-Asian collision. However, the history and tectonic significance of deformation and sedimentation in Tibet during this time interval have remained enigmatic. We show that contractional structures and clastic rocks near the city of Lhasa can be attributed to the development of a northward-propagating retroarc thrust belt that was active between 105 and 53 Ma. A kinematic model shows that the thrust belt could have accommodated >230 km (>55%) of N-S shortening. An episode of large magnitude (>160 km) and rapid (>8 mm/yr) shortening predated the onset of a magmatic flare-up ca. 69 Ma, which is linked to removal of overthickened mantle lithosphere. This tectonic history implies that southern Tibet underwent substantial crustal thickening and elevation gain prior to the Indo-Asian collision.

Keywords: Tibet, plateau, retroarc thrust belt, Lhasa terrane, Gangdese.

INTRODUCTION

During the Late Cretaceous to Eocene, the convergence rate between the Indian and Asian plates exceeded 10 cm/yr (e.g., Patriat and Achache, 1984; Klootwijk et al., 1992; Lee and Lawver, 1995). This convergence was coeval with northward subduction of Neotethyan oceanic lithosphere beneath southern Asia and the development of the Gangdese continental magmatic arc in southern Tibet (e.g., Schärer et al., 1984). An angular unconformity in the Lhasa terrane between strongly shortened Cretaceous and older strata and overlying, weakly deformed uppermost Cretaceous to lower Tertiary volcanic-bearing strata of the Linzizong Formation (Fig. 1) has led to speculation that there is a contractional (Cordilleran-style) orogen related to the Gangdese arc (e.g., Burg et al., 1983; England and Searle, 1986; Ratschbacher et al., 1992). However, the hypothetical thrust belt has not been documented and only parts of the expected foreland basin system have been recently recognized (Leier et al., 2007).

We present initial results of ongoing work in the Lhasa region (Figs. 1 and 2). We document a retroarc thrust belt and foreland basin associated with the Cretaceous–early Tertiary Cordilleran-style southern margin of Asia. Our results and interpretations provide an integrated picture of the Gangdese continental margin tectonic system and shed light on the nature of the Tibetan lithosphere prior to the Indo-Asian collision.

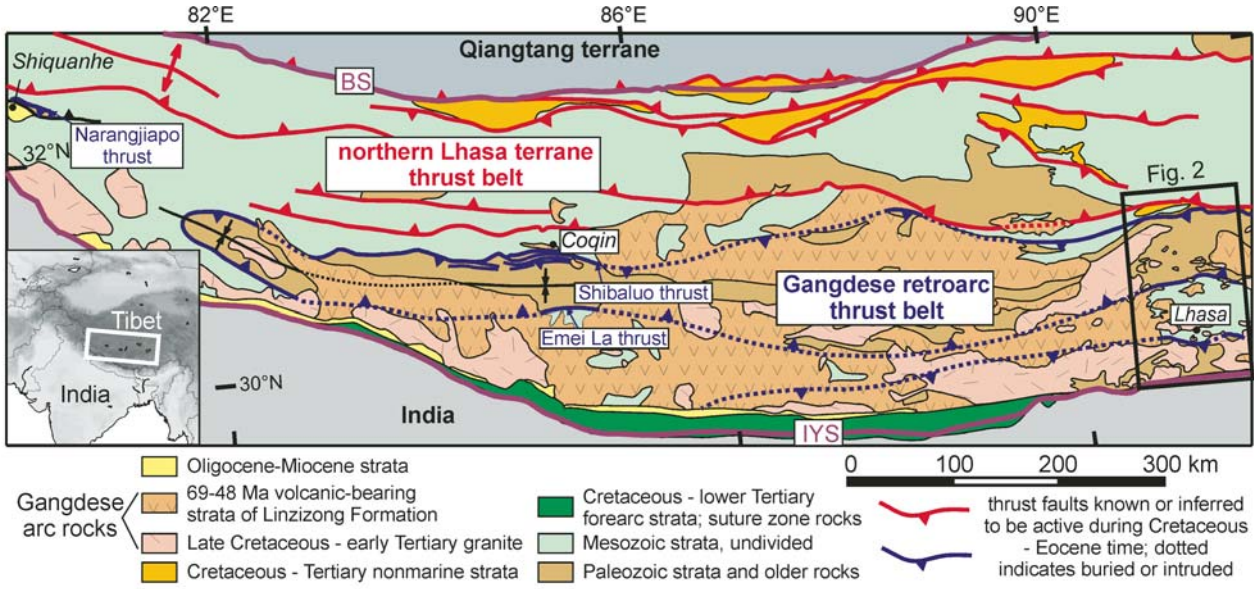

Figure 1. Tectonic map of southern Tibet modified from Kapp et al. (2003). Distribution of Paleozoic strata based on Liu (1988). BS—Bangong suture; IYS—Indus-Yarlung suture.

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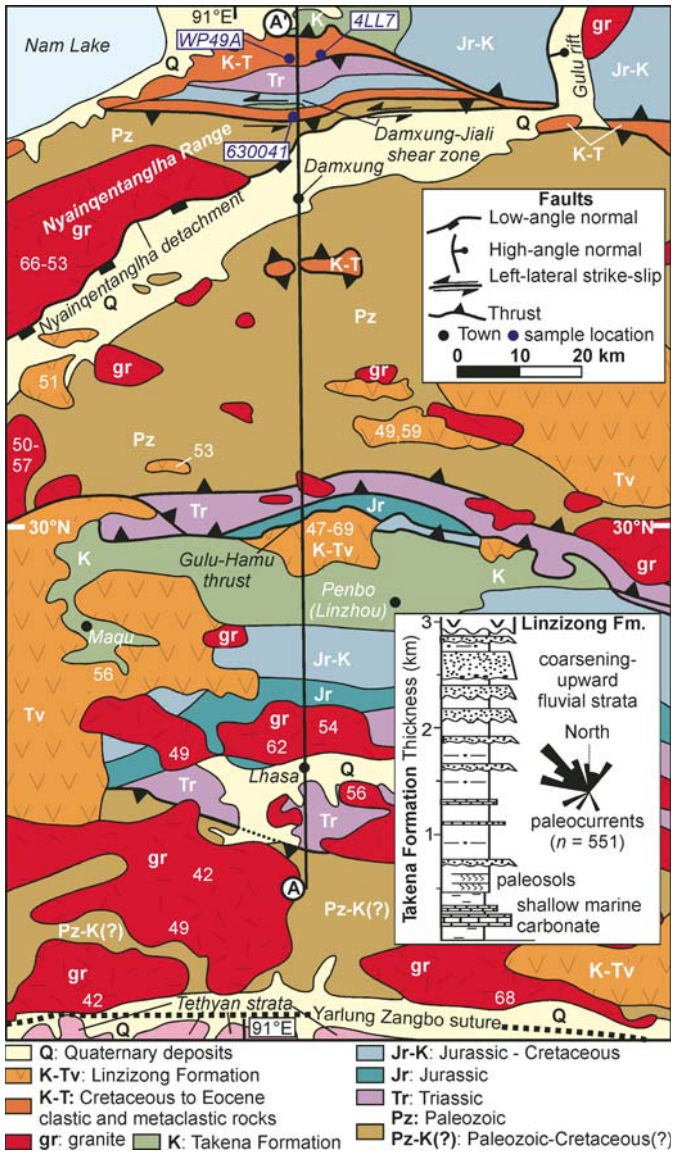

Figure 2. Simplified geologic map of the Lhasa region modified from Kidd et al. (1988) to account for our new mapping and age data. White numbers: crystallization ages of igneous rocks in m.y. (Schärer et al., 1984; Xu et al., 1985; Coulon et al., 1986; Copeland et al., 1987, 1995; Pan, 1993; Mo et al., 2003; Kapp et al., 2005a; He et al., 2007). Schematic stratigraphic column for the Takena Formation is based on measured sections presented in Leier et al. (2007).

THE TAKENA FORMATION: RETROARC FORELAND BASIN DEPOSITS

The Takena Formation consists of an ~250-m-thick lower unit of Aptian-Albian marine carbonate parasequences that is conformably overlain by an ~100-m-thick zone of stacked paleosol horizons and >2 km of upward coarsening fluvial redbeds (Fig. 2; Leier et al., 2007). Paleocurrent indicators demonstrate dominantly northwestward paleoflow (Fig. 2). The presence of metasedimentary clasts and abundant plagioclase and volcanic grains in sandstones imply derivation from the Gangdese arc and metasedimentary country rocks to the south (Fig. 2). The upward-coarsening trend within the Takena Formation, combined with a subsidence history of initial slow accumulation followed by progressively increasing rates, is indicative of a foreland basin setting (Jordan, 1995; DeCelles and Giles, 1996). The lowermost ca. 105 Ma limestones and overlying paleosol-rich strata are interpreted to represent flexural backbulge-forebulge deposits (e.g., Dorobeck, 1995; DeCelles and Giles, 1996) that accumulated during the initial stages of retroarc foreland basin development. The age of the youngest Takena redbeds is ca. 90 Ma.

NORTH-DIRECTED THRUST FAULTS NEAR LHASA AND PENBO

An E-W–striking fault interpreted to have exhumed arc and metasedimentary rocks coeval with Takena deposition is located ~12 km south of Lhasa (Fig. 2). It is subvertical and juxtaposes Paleozoic to Cretaceous (?) metasedimentary rocks to the south against lower-grade Triassic strata in the north (Kidd et al., 1988). The fault predates Indo-Asian collision; it is intruded by Paleocene-Eocene granites and unconformably overlain by ca. 56 Ma Linzizong volcanic rocks (Xu et al., 1985; Fig. 2). Although previously interpreted to be a N-dipping thrust, we raise the possibility that it is a N-directed thrust fault (with higher-grade rocks in the hanging wall) that has been tilted southward.

A stack of N-dipping thrust sheets is exposed ~15 km north of Penbo (Fig. 2). One of these thrusts is S-directed and cuts strata as young as ca. 47 Ma in its footwall (He et al., 2007), whereas the structurally highest thrust with Paleozoic strata in the hanging wall is intruded by a suite of granites that has been dated to 57–50 Ma along strike to the west (Fig. 2). Preliminary observations suggest that the structurally highest thrust is a folded N-directed thrust (Fig. 3). Cretaceous and older strata were strongly folded prior to Linzizong volcanism. Whereas many of the folds are upright (Burg et al., 1983; Ratschbacher et al., 1992; Pan, 1993), hundreds-of-meter-wavelength overturned folds near Penbo show northward vergence (Fig. 3A). Cleavage planes in cataclasite within the structurally highest thrust fault zone dip more gently to the north than the fault plane (indicating a top-to-the-north sense-of-shear), and asymmetric mesoscopic folds in the hanging wall show northward vergence (Fig. 3B; He et al., 2007).

THRUST FAULTS IN THE NYAINQENTANGLHA RANGE

The Nyainqentanglha Range north of Damxung (Fig. 2) exposes metasedimentary rocks of previously inferred Paleozoic age (Kidd et al., 1988; Liu, 1988), although recent studies suggest that some of these rocks may be as young as Cretaceous (Edwards and Ratschbacher, 2005; Kapp et al., 2005a). Our mapping shows that metasedimentary rocks within the core of the range are regionally S-dipping and include Aptian-Albian metalimestone and >2 km of overlying metaclastic rocks. A U-Pb detrital zircon age spectrum for a metasandstone collected ~1.8 km tectonostratigraphically above the metalimestone (630041; Fig. 2) shows prominent Early Cretaceous and early Tertiary peaks (Fig. 4A). We interpret the Cretaceous-Tertiary zircons to have been derived from the Gangdese arc to the south and the peak age of the youngest zircon population (ca. 54 Ma) to provide a maximum depositional age. Within the late Cenozoic Damxung-Jiali shear zone to the south (Fig. 2; Edwards and Ratschbacher, 2005), the metaclastic rocks are exposed structurally beneath S-dipping Paleozoic metasedimentary rocks. We suggest that the Tertiary clastic rocks were initially juxtaposed against the Paleozoic rocks by a S-dipping, N-directed thrust (Figs. 2 and 3).

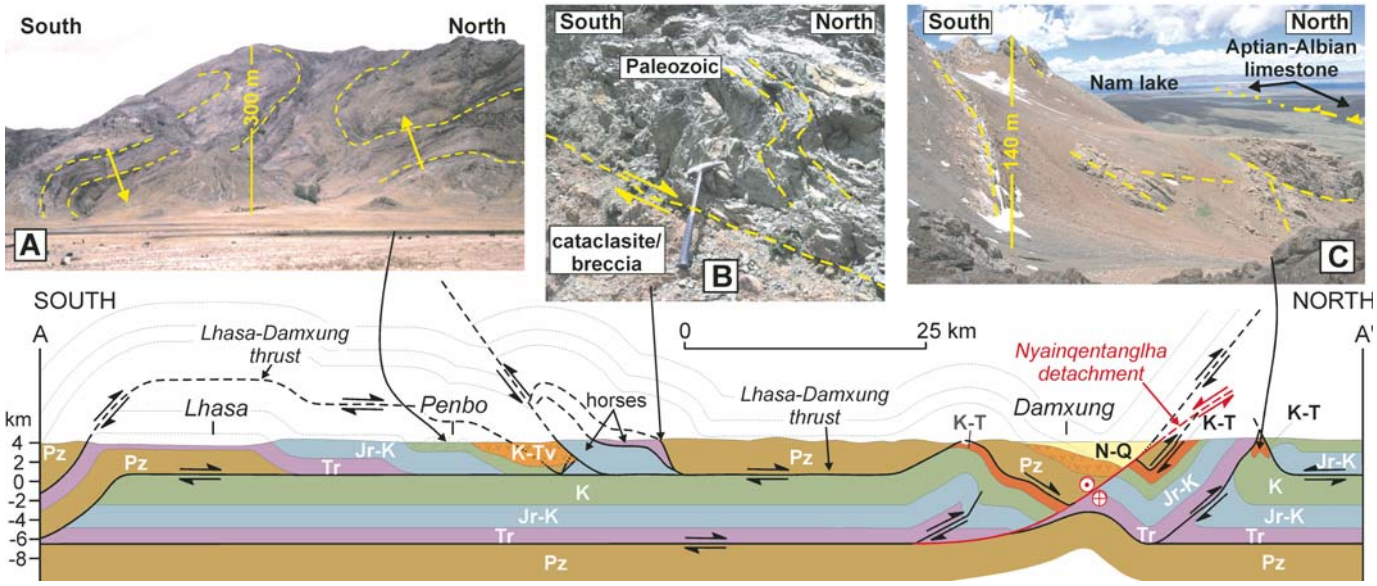

Figure 3. Cross section of the Lhasa region constructed from the simplified geological map and using unit abbreviations in Figure 2. For clarity, intrusive rocks are excluded. (A) Northward-verging folds in Cretaceous strata near Penbo. Arrows: stratigraphic facing direction. (B) Structurally highest N-dipping thrust fault north of Penbo. (C) Syncontractional, lower Eocene redbeds along the northern flank of the Nyainqentanglha Range.

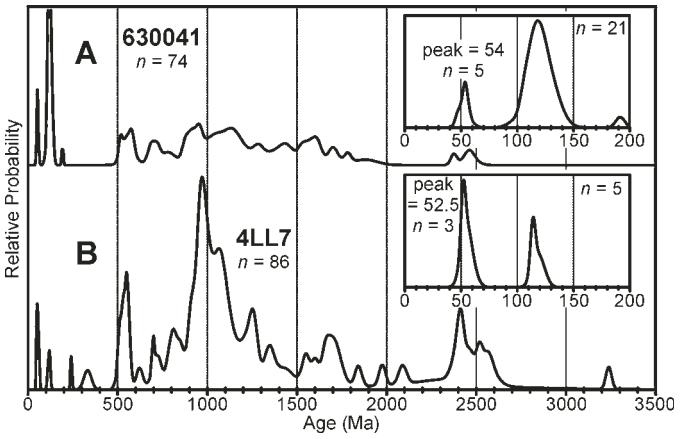

Figure 4. Relative probability detrital zircon age plots for (A) metaclastic sandstone and (B) redbeds within the Nyainqentanglha Range. The peak of the youngest age population of zircons provides a maximum depositional age and likely closely approximates the depositional age. Plotted ages are based on $^{206}Pb/^{238}U$ for grains <1000 Ma and $^{206}Pb/^{207}Pb$ for grains >1000 Ma. Spot analyses on individual zircon grains were made using a laser ablation, multicollector inductively coupled plasma mass spectrometer at the Arizona LaserChron Center. A tabulation of U-Pb data and a description of the analytical methods are provided in the GSA Data Repository (see text footnote 1).

Along the northern flank of the Nyainqentanglha Range, conglomeratic redbeds of previously inferred Cretaceous age are locally exposed in the footwall of a S-dipping thrust to the south and a N-dipping thrust to the north (Fig. 2). The conglomerates exhibit variable dips and intraformational unconformities (Fig. 3C), demonstrating that they are synkinematic, and are interpreted to have been deposited during slip on both the N- and S-directed faults (Fabijanic, 2005). These geological relations define a triangle zone, a structure common in the frontal parts of thrust belts (e.g., Jones, 1982; Vann et al., 1986). The depositional age of the redbeds, and hence the timing of contraction, is constrained by a U-Pb zircon date of 53 ± 2 Ma for an interbedded tuff layer (WP49A; Fig. 2) and the presence of detrital zircons of statistically indistinguishable age (4LL7; Figs. 2 and 4B). The GSA Data Repository[1] includes a description of the U-Pb analytical methods and a tabulation of the U-Pb data (Table DR1).

THE PROPOSED GANGDESE RETROARC THRUST BELT

A sequential restoration (Fig. 5) of the cross section of the Lhasa region (Fig. 3) shows that Late Cretaceous–Eocene contractional structures and clastic rocks in the Lhasa region formed in a northward directed and propagating retroarc thrust belt and foreland basin system. The largest displacement "Lhasa-Damxung thrust" carries Paleozoic strata in the hanging wall. This thrust (1) roots into the subsurface south of Lhasa, (2) was passively folded into an antiform between Lhasa and Penbo, (3) structurally overlies horses of Mesozoic strata north of Penbo, (4) has tectonic windows that expose footwall Cretaceous–lower Tertiary (?) redbeds between Penbo and Damxung, and (5) resurfaces in the Nyainqentanglha Range (Fig. 3). The youngest and most northward feature of the thrust belt is the lower Eocene triangle zone along the northern flank of the Nyainqentanglha Range (Fig. 3).

The kinematic history of the thrust belt during Takena deposition is unknown. At least 160 km of shortening is required to (1) account for the N-S length of Paleozoic strata carried in the hanging wall of the Lhasa-Damxung thrust, and (2) emplace underlying horses of Mesozoic strata (Fig. 5A). This shortening

[1]GSA Data Repository item 2007173, tabulation of U-Pb data and description of the analytical methods, is available at www.geosociety.org/pubs/ft2007.htm. You can also obtain a copy by writing to editing@geosociety.org.

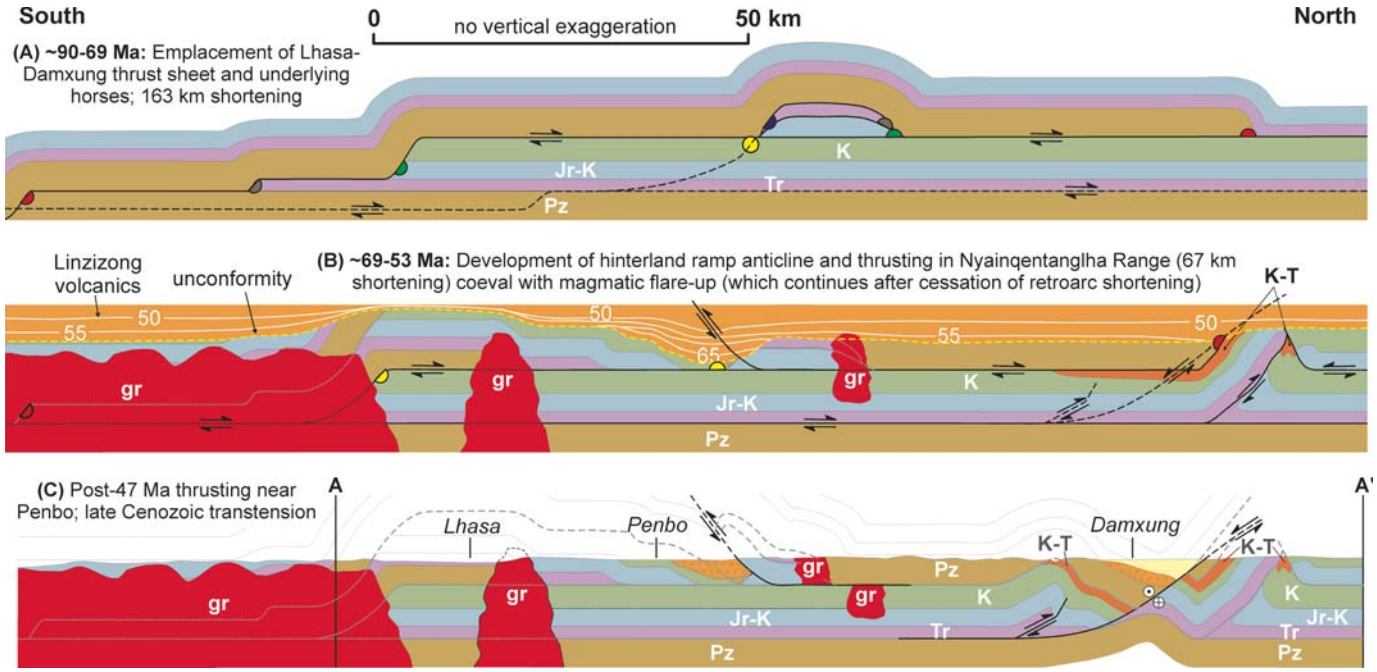

Figure 5. Proposed kinematic evolution of the Gangdese retroarc thrust belt. Unit abbreviations as in Figure 2. (A) Large magnitude and rapid N-directed shortening between ca. 90 and 69 Ma. (B) Development of hinterland ramp anticline during a phase of slower shortening rate. This deformation was coeval with the development of the basal Linzizong unconformity and widespread magmatism. White numbers and lines: speculated age distribution (in m.y.) of Linzizong volcanic rocks above the unconformity. (C) Present-day upper-crustal structure with cross-section lines from Figures 2 and 4.

occurred after deposition of the youngest Takena redbeds (ca. 90 Ma) and before the onset of Linzizong volcanism near Penbo ca. 69 Ma. The length of the horses shown is the minimum required to explain the map pattern (Fig. 2) and minimizes our shortening estimate; the horses could have extended much farther southward beneath the Lhasa-Damxung thrust, possibly even rooting into the structurally complex zone of metasedimentary rocks in the hanging wall of the Lhasa-Damxung thrust south of Lhasa (Fig. 2). The interpretation shown equates to a shortening rate of ~8 mm/yr, comparable to that estimated for the Andean thrust belt in Bolivia (5–10 mm/yr; e.g., McQuarrie, 2002).

There is no direct evidence for contraction between ca. 69 and ca. 53 Ma; however, during this time interval, arc magmatism swept northward (Fig. 6). This could have been due to shallowing of the subducting oceanic slab or shortening within the forearc; both scenarios are consistent with continued contraction. We suggest that between 69 and 53 Ma, slip along a S-dipping thrust in the hinterland produced a ramp anticline and passively folded the Lhasa-Damxung thrust (Fig. 5B). This slip, together with slip along a structurally lower décollement beneath Triassic strata, fed northward to thrusts that surfaced in the Nyainqentanglha Range.

A hinterland ramp anticline provides a simple explanation for the regional northward dip of Triassic–lower Tertiary strata in the Penbo region (Fig. 3). Growth of this anticline was coeval with deposition of the Linzizong Formation and should be recorded by lateral variations in the age and thickness of Linzizong strata (Fig. 5B). In fact, the oldest Linzizong volcanic rocks dated to the north of the anticline forelimb are 69–59 Ma, whereas those along the anticline crest in the Maqu area are ≤59 Ma (Fig. 2). Shortening during the 69–53 Ma time interval is estimated to be ~67 km

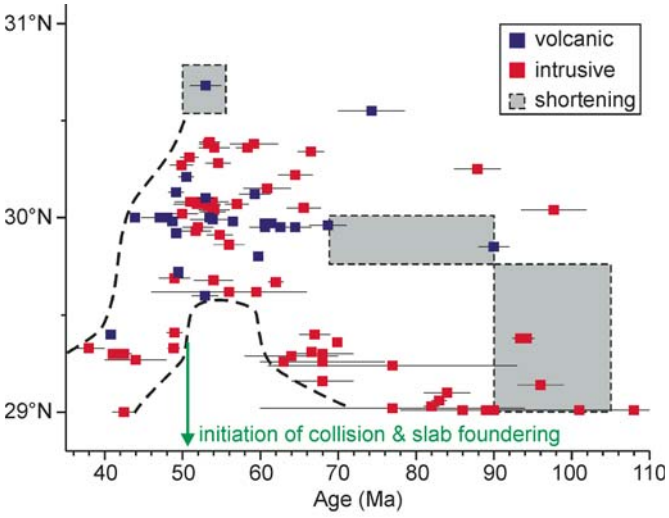

Figure 6. Temporal-spatial distribution of magmatism (from 85°E to 94°E) and documented shortening (Lhasa area) in the southern Lhasa terrane. The Indus-Yarlung suture is located at 29°N. Ages compiled from Maluski et al. (1982), Quidelleur et al. (1997), Harrison et al. (2000), and Wu et al. (2004), in addition to references cited in Figure 2 caption.

(Fig. 5B), yielding an average shortening rate of ~4 mm/yr. More sophisticated interpretations to explain the structural relief in the hinterland will likely emerge; however, we assert that three conclusions are robust: (1) the structural culmination between Lhasa and Penbo grew in part coeval with Linzizong volcanism, (2) the magnitude and rates of shortening before 69 Ma were substantially greater than those after 69 Ma, and (3) the retroarc thrust

belt was not significantly disrupted during the Indo-Asian collision (Fig. 5C).

Remnants of the Gangdese retroarc thrust belt may be exposed over a distance of >1000 km along strike to the west of Lhasa. South of the town of Coqin (Fig. 1), Paleozoic strata are exposed in the hanging wall of a S-dipping thrust to the north and a N-dipping thrust to the south, both of which were active during the Cretaceous (Murphy et al., 1997). The Paleozoic strata were interpreted to core a pop-up structure between thrusts of opposing vergence. We favor an alternative interpretation in which the two faults form a single folded N-directed thrust that carries Paleozoic strata in the hanging wall (Fig. 1). This interpretation is consistent with the geology farther west near Shiquanhe (Fig. 1), where the Narangjiapo thrust emplaced Paleozoic strata northward over Cretaceous rocks during the Late Cretaceous (Fig. 1; Kapp et al., 2003).

DISCUSSION

Crowding and Removal of Lithosphere beneath the Gangdese Arc

By ca. 105 Ma, a Cordilleran-style margin was established in southern Tibet and, from south to north, included the Gangdese (Xigaze) forearc basin (e.g., Dürr, 1996), arc, and retroarc thrust belt and foreland basin system. Between 90 and 69 Ma, rapid (≥8 mm/yr) retroarc shortening resulted in southward underthrusting of a large volume of crust and mantle lithosphere beneath the arc (Fig. 7A). Crowding of lithosphere beneath the arc may have provided a resisting force to continued retroarc shortening, explaining the subsequent marked decrease in shortening rate. Between 69 and 62 Ma, ophiolites were obducted onto accretionary mélange within the Indus-Yarlung suture zone (Fig. 1), coeval with shortening and the development of an angular unconformity within the forearc (Fig. 7B; Ding et al., 2005). Ophiolite obduction required removal of upper plate mantle lithosphere. This could have occurred through tectonic erosion by the subducting slab and/or gravitational foundering of lithosphere beneath the arc (Fig. 7B). Concomitant upwelling of asthenosphere, in combination with partial melting of melt-fertile crust that was underthrust beneath the arc, can explain ignition of the 69 Ma and younger magmatic flare-up within the Gangdese arc (Fig. 7). Similar geodynamic processes have been invoked to explain correlations between the tempo of retroarc shortening and magmatism in the Cordillera of the western United Sates (e.g., Ducea, 2001; DeCelles, 2004).

Development of a "Lhasaplano"?

The proposed Gangdese retroarc thrust belt accommodated >230 km of shortening (>55%) in the Lhasa region. Crustal thickening and lithosphere removal in response to this shortening may have led to the development of a high-elevation "Lhasaplano" (Fig. 7B). The basal Linzizong unconformity is presently a gently dipping surface at similar elevations across much of the Lhasa terrane (Fig. 1), implying that a regional low-relief landscape was established prior to the Indo-Asian collision.

A major difference with an Andean-style margin is that the Gangdese retroarc thrust belt overlapped in age with the S-directed northern Lhasa terrane thrust belt to the north (Fig. 1; Murphy et al., 1997; Kapp et al., 2003, 2005b). Paleoaltimetric studies suggest that the northern Lhasa terrane achieved

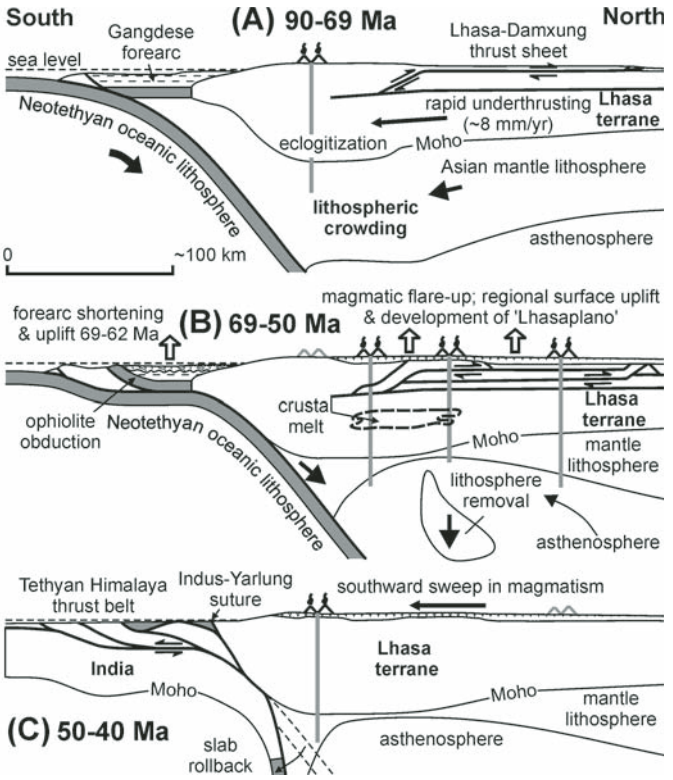

Figure 7. Proposed evolution of the Gangdese continental margin tectonic system. (A) Retroarc shortening results in underthrusting and crowding of lithosphere beneath the arc. (B) Shortening slows down in the retroarc region while it accelerates in the forearc region. Lithosphere removal beneath the arc ignites a magmatic flare-up. (C) India collides, the India-Asia convergence rate drops, the Neotethyan oceanic slab rolls back, and retroarc shortening ceases as shortening of Indian continental margin strata initiates in the Tethyan Himalaya.

near-modern elevations by the late Eocene (Rowley and Currie, 2006) and certainly no later than the late Oligocene (DeCelles et al., 2007). How much elevation was produced in this and other regions of Tibet by contractional tectonism prior to the Indo-Asian collision remains to be quantified.

Demise of Retroarc Shortening, Slab Rollback, and Collision

The cessation of major retroarc shortening at 50–55 Ma marked the initiation of a southward sweep in magmatism within the arc (Fig. 6) and Indo-Asian collision in south-central Tibet (e.g., Besse et al., 1984; Zhu et al., 2005). The magmatic sweep is interpreted to reflect rollback of the Neotethyan oceanic slab in response to a decrease in India-Asia convergence rate as the Indian continental margin entered the trench (Fig. 7C) (e.g., Patriat and Achache, 1984). Major upper crustal shortening during the early stages of collision was localized to the south in the Tethyan Himalaya (Fig. 7C; e.g., Ratschbacher et al., 1994) and to the north of the southern Qiangtang terrane (Fig. 1; e.g., Coward et al., 1988; Horton et al., 2002; Spurlin et al., 2005). The gravitational potential energy related to thick crust and high elevation in the Lhasa and southern Qiangtang terranes may, therefore, have been sufficient to inhibit major shortening in these areas and to focus contractional deformation along its lower elevation northern and southern margins (e.g., England and Searle, 1986).

ACKNOWLEDGMENTS

This research was supported by National Science Foundation grant EAR-0309844. The Geological Map of the Academia Sinica-Royal Society Geotraverse (Kidd et al., 1988) was invaluable in guiding our field investigations and interpretations. This paper benefited greatly from comments by Tom Argles, Laurent Godin, Stephen Johnston, Gautam Mitra, David Rowley, and An Yin.

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COMMENT AND REPLY
John Perry's neglected critique of Kelvin's age for the Earth: A missed opportunity in geodynamics, Philip England, Peter Molnar, and Frank Richter, *GSA Today*, v. 17, no. 1, p. 4–9, doi: 10.1130/GSAT01701A.1.

Comment

Anne M. Hofmeister *and* ***Robert E. Criss,*** *Department of Earth and Planetary Science, Washington University, St. Louis, Missouri 63130, USA, hofmeist@wustl.edu*

In touting John Perry, England et al. (2007) misrepresent modern and historical efforts to understand Earth's cooling.

Perry promulgated Kelvin's fundamental error of using equations inappropriate for cooling of a large, finite sphere. Both plate and Kelvin-type models contain unrealistic boundary conditions and inputs (Hofmeister and Criss, 2005, 2006). Perry used a surface temperature (*T*) of 146 °C and interior thermal conductivity (*k*) 79 times crustal *k*. By comparing cooling of a homogeneous infinite half-space to a thin spherical shell, Perry deduced that high interior *k* slows cooling.

England et al. agree and link high interior *k* to mantle convection. In contrast, high *k* makes conduction efficient (Lubimova, 1958) and convection unnecessary. Time-dependent convection models (van den Berg et al., 2004) show low upper mantle *k* retards cooling. Geodynamic research requested by England et al. exists and shows them wrong.

England et al. cite secondary, outdated sources for high *k*. Suspicious upturns giving high vibrational *k* at high *T* are proven experimental artifacts (Pertermann and Hofmeister, 2006). Radiative diffusion in Earth's mantle cannot provide high *k* (Preston, 1956; Hofmeister, 2005). Consequently, deep interior *k* resembles surface values (Hofmeister, 1999).

Likewise, 20 TW for Earth's radioactive heat generation is neither modern nor correctly attributed. Chondritic models reconcile heat flow data with radioactivity within uncertainties (Urey, 1956; Hofmeister and Criss, 2005).

Kelvin's famous calculations, coupled with denial of observational data, impeded geoscience for ~100 yr. It is a shame to see data ignored and Perry lionized given his statement "I dislike very much to consider any quantitative problem set by a geologist."

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STUDENTS: Annual Meeting Field Trip Scholarships Offered

As part of the Roy J. Shlemon Meeting Awards Program, the **GSA Engineering Geology Division** is providing funding for two students to attend GSA Annual Meeting field trips. The scholarships will cover the price of the field trip. You must be a student member of the Engineering Geology Division making satisfactory progress toward your degree. For a detailed description of this program, you can visit the Division Web site, http://rock.geosociety.org/egd/index.html and click on "Scholarships." If you need more information, contact Rob Larson at ralarson@dslextreme.com. **Deadline for applications:** 1 August 2007.

The **GSA Geoscience Education Division** is offering US$50 scholarships for students to participate in division-sponsored field trips. This subsidy is for the first five student registrants who are valid Division members. Students: please pay the full field trip fee when you register; the Geoscience Education Division will be reimburse you after the GSA meeting. Visit the Geoscience Education Division Web site, http://gsaged.org/ for contact information.

The **GSA Geobiology and Geomicrobiology Division** will be offering one student scholarship to cover the registration costs for field trip number 403, "Cornucopia of coal and coalbed gas in the Powder River Basin: From mining and utilization to methane and methanogens." The student must be a Geobiology and Geomicrobiology Division member in

Reply

Philip England, *Department of Earth Sciences, Oxford University, Parks Road, Oxford OX1 3PR, UK;* ***Peter Molnar,*** *Department of Geological Sciences and Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, Colorado 80309, USA;* ***Frank Richter,*** *Department of the Geophysical Sciences, University of Chicago, 5734 S. Ellis Ave., Chicago, Illinois 60637, USA*

In touting their views, Hofmeister and Criss (2007) misrepresent what we wrote, what Perry wrote, and some simple aspects of heat transfer.

Hofmeister and Criss accuse Perry of deducing that high interior thermal conductivity slows cooling of the Earth and us of agreeing with that deduction. Neither accusation is correct. Perry showed that higher interior conductivity would quicken cooling of the Earth, thereby making the present surface heat flux compatible with a much greater age than Kelvin calculated; we agree with Perry.

Hofmeister and Criss appear to believe that high conductivity makes convection unnecessary. Even were this belief correct, which it is not, it would be a non sequitur; our purpose was to draw attention to Perry's contention that convection in the Earth's interior can be modeled by a high "quasi-conductivity." They write that we requested geodynamic research on this topic. We did not, because high-Prandtl–number convection has been understood for decades; there is no need for complicated models. Convection can maintain the Earth's surface heat flux at its observed level for gigayears, whereas thermal diffusion cannot. Hofmeister and Criss join Kelvin in missing this point.

Equally, their arguments about radiogenic heating in the Earth's deep interior are irrelevant because its influence on Kelvin's calculation is utterly negligible with the value we adopt, and two-thirds as negligible with the value they prefer.

Hofmeister and Criss write that we cite "secondary, outdated sources" for measurements of thermal conductivity. We cite no source at all for such measurements, not even theirs, because they are not relevant to our arguments. Perhaps they were confused by our remark that Perry's "quasi-conductivity" could be expressed in modern terms by the Nusselt number. However, even a superficial reading of the works we cite in this context would have revealed that they concern convection, not conduction.

Their final paragraph is purely rhetorical. Kelvin did not ignore observations; indeed, his attempts to use observations to constrain the age of the Earth forced geologists to abandon their reckless drafts on the bank of time. Hofmeister and Criss's dismissal of this history as Kelvin's "impeding geoscience for ~100 years" is not supported by serious work on the matter. Furthermore, their attack on Perry shows a complete misunderstanding of a modest and conciliatory person. Perry's reluctance "to consider any quantitative problem set by a geologist" should be taken as an expression of qualms about his ability to combine geology and physics, not as hubris.

We should like to take this opportunity of directing the interested reader to Shipley (2001), who provides an excellent description of the background to Perry's exchanges with Kelvin in 1894–1895.

Thanks to Patrick Wyse Jackson for drawing Shipley (2001) to our attention and Norman Sleep for supportive comments.

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order to receive this US$290 scholarship. For more information, contact Stuart Birnbaum at stuart.birnbaum@utsa.edu.

The **Structural Geology and Tectonics Division** of GSA is also offering scholarships to student Division members to take part in GSA Annual Meeting field trips. Awards are of variable size, but can be as much as the full cost of the field trip, depending on the number and size of requests. If you are interested in applying for a scholarship, please send an e-mail with the following information to Bill Dunne, SGT Division chair, at wdunne@utk.edu: field trip and cost; description of how the field trip complements thesis research (up to 1 page in length); and confirmation of Division student membership.

GSA Names 2007 Medal and Award Recipients

GSA medals and awards for 2007 will be presented during the Presidential Address & Awards Ceremony at the 2007 GSA Annual Meeting in Denver on Saturday, 27 October, at the Hyatt Regency Denver at Colorado Convention Center.

PENROSE MEDAL
Kevin C.A. Burke
University of Houston

ARTHUR L. DAY MEDAL
Mary Lou Zoback
Risk Management Solutions

YOUNG SCIENTIST AWARD
(DONATH MEDAL)
Carmala N. Garzione
University of Rochester

GSA PUBLIC SERVICE AWARD
Mary Lou Zoback
Risk Management Solutions

GSA DISTINGUISHED SERVICE AWARD
Nancy L. Carlson
GSA Technical Program Manager

Yildirim Dilek
Miami University

Robert C. Thomas
University of Montana–Western

HONORARY FELLOWS
Cheng-Fa Chang
Chinese Academy of Sciences

Maarten J. de Wit
University of Cape Town

SUBARU OUTSTANDING WOMAN IN SCIENCE AWARD
(Sponsored by Subaru America Inc.)
Tanja Bosak
Harvard University

AGI MEDAL IN MEMORY OF IAN CAMPBELL
Arthur A. Socolow
Pennsylvania Geological Survey (retired)

JOHN C. FRYE ENVIRONMENTAL GEOLOGY AWARD
David K. Brezinski, for Brezinski, D.K., 2004, Stratigraphy of the Frederick Valley and its relationship to karst development, Maryland Geological Survey, Report of Investigation 75, 101 p.

RIP RAPP ARCHAEOLOGICAL GEOLOGY AWARD
Norman Herz
University of Georgia

GILBERT H. CADY AWARD
(Coal Geology Division)
Andrew Cunningham Scott
Royal Holloway, University of London

E.B. BURWELL, JR., AWARD
(Engineering Geology Division)
Fred G. Bell, British Geological Survey, and **Laurance J. Donnelly,** Halcrow, Deanway Technology Centre, *for* Bell, F.G., and Donnelly, L.J., 2006, Mining and its Impact on the Environment: New York, Taylor & Francis Group, 547 p.

GEORGE P. WOOLLARD AWARD
(Geophysics Division)
Alan Levander
Rice University

MARY C. RABBITT HISTORY OF GEOLOGY AWARD
Kenneth L. Taylor
University of Oklahoma

O.E. MEINZER AWARD
(Hydrogeology Division)
Shaun K. Frape
University of Waterloo

DISTINGUISHED CAREER AWARD
(International Division)
Alan Gilbert Smith
Cambridge University

G.K. GILBERT AWARD
(Planetary Geology Division)
Maria T. Zuber
Massachusetts Institute of Technology

KIRK BRYAN AWARD FOR RESEARCH EXCELLENCE
(Quaternary Geology and Geomorphology Division)
Marith Cady Reheis, U.S. Geological Survey, Denver *for* Reheis, M.C., Sarna-Wojcicki, A.M., Reynolds, R.L., Repenning, C.A., and Mifflin, M.D., 2002, Pliocene to middle Pleistocene lakes in the western Great Basin-Ages and connections, *in* Hershler, R., Currey, D., and Madsen, D., eds., Great Basin Aquatic Systems History: Smithsonian Contributions to Earth Sciences no. 33: Washington, D.C., Smithsonian Institution Press, p. 53–108.

LAWRENCE L. SLOSS AWARD
(Sedimentary Geology Division)
Michael A. Arthur
Pennsylvania State University

CAREER CONTRIBUTION AWARD
(Structural Geology and Tectonics Division)
Warren B. Hamilton
Colorado School of Mines

2007 GSA FELLOWS

Elected by Council 29 April 2007

GSA's newly elected Fellows will be recognized at the 2007 GSA Annual Meeting Presidential Address & Awards Ceremony on Saturday, 27 October, at the Hyatt Regency Denver at Colorado Convention Center.

Sarah Andrews, Author

"Sarah Andrews is nominated for Fellowship in the GSA for her contributions to GSA Foundation activities, her ideas about how to teach geology effectively, and her portrayal of geology and geologists through widely read novels and short stories."

—Michele Aldrich

Jonathan D. Arthur, Florida Geological Survey

"Jonathan Arthur is being nominated for Fellowship in the GSA as a result of his efforts in conducting research aimed at the protection of Florida's groundwater and determining the water/rock interactions during aquifer storage and retrieval cycling. Also, his efforts in administering programs and professional organizations support his nomination."

—Thomas M. Scott

Jean H. Bédard, Geological Survey of Canada

"A distinguished petrologist and geochemist, he has applied a combination of mapping, petrology, mineral chemistry, numerical modeling, and experimental simulation to the understanding of the genesis and evolution of oceanic and continental crusts and mantle of eastern North America, from the Archean to the present, discovering new petrogenetic mechanisms and disproving long-held hypotheses and dogmas."

—John F. Riva

Brian Berkowitz, Weizmann Institute of Science, Israel

"Brian Berkowitz has earned a worldwide reputation as an influential leader in subsurface hydrology. He has made critical, diverse contributions to conceptual understanding and mathematical description of fluid flow and chemical transport processes in heterogeneous geological media. His research is based on both innovative theory and laboratory experiments."

—Steven M. Gorelick

Alan R. Carroll, University of Wisconsin–Madison

"Alan Carroll has made fundamental contributions to our understanding of continental depositional systems through his integration of the wide range of tectonics and basin analysis with sedimentology, stratigraphy, geomorphology, and organic and inorganic geochemistry. He is widely cited, active in the Limnogeology Division, and his students become confident, creative researchers."

—Kevin M. Bohacs

Elizabeth J. Catlos, Oklahoma State University

Elected to Fellowship as the 2006 GSA Young Scientist Award–Donath medalist.

Peter A. Copeland, University of Houston

"I nominate Peter Copeland of the University of Houston for his sustained and strategic contributions to understanding the tectonics of key regions around the world using $^{40}Ar/^{39}Ar$ thermochronometry and for his diligent and insightful stewardship of the *GSA Bulletin* as associate editor and editor through the transition years of 1997–2004."

—E. Bruce Watson

H. Allen Curran, Smith College

"Al Curran is a masterful carbonate sedimentologist, paleontologist, and teacher. His publications number over 100 articles, books, book chapters, and guidebooks extending back over 30 years. He has trained several generations of geologists, imparting to each his distinctive scientific rigor, deep curiosity, and diversity of ideas."

—Mark Allan Wilson

Larissa F. Dobrzhinetskaya, University of California at Riverside

"Larissa Dobrzhinetskaya is nominated for her significant contributions in characterization of nanoscale inclusions in microdiamonds from ultrahigh-pressure metamorphic terranes and in experimental modeling the fate of continental materials at subduction channels. Her research triggered a synergy of research in mineral physics and provides new insights of continent subduction, collision, and mantle dynamics."

—Juhn G.G. Liou

Rebecca J. Dorsey, University of Oregon

"Becky Dorsey is nominated for her major contributions to understanding the history and processes in many critical areas of the Pacific–North America plate boundary. Becky is a leader in research in structurally complex sedimentary basins along both young and ancient plate margins."

—Paul J. Umhoefer

Barbara Lee Dutrow, Louisiana State University

"Barb Dutrow is an accomplished and widely published researcher and educator in the fields of mineralogy and metamorphic petrology. Her research on heat and mass transport in heterogeneous porous media and study of thermal and chemical effects of fluids on metamorphic genesis is widely recognized as innovative and influential."

—Ren A. Thompson

Judith E. Fierstein, U.S. Geological Survey, Menlo Park

"Judy Fierstein is known for her comprehensive publications on volcano geology and physical volcanology of pyroclastic deposits in Alaska, the Cascades, and the Andes. Her research forms the basis for hazard assessment at several major volcanic centers. Judy effectively communicates her enthusiasm for volcanology to K–12 students and the public."

—Charles R. Bacon

Katherine H. Freeman, Pennsylvania State University

"Katherine Freeman has made lasting contributions to the fields of organic and stable isotope geochemistry as a world-renowned innovator in the use of compound-specific stable isotopes to solve geologic problems. Her work on carbon and other isotopes has elucidated the evolution of environment and life over geologic time."

—Lee R. Kump

Paul H. Glaser, University of Minnesota

"For over 30 years, Paul H. Glaser has led research initiatives on the linkages among ecology, geochemistry, geology, and hydrology of large peatlands. This leadership record, coupled to numerous intellectual contributions, serves as a template for how multidisciplinary research in the earth and biological sciences can be successfully done."

—Donald I. Siegel

Ethan L. Grossman, Texas A&M University

"Ethan Grossman has contributed to geology through pioneering research in stable isotope geochemistry and its application to paleoecology, aquifer, and groundwater chemistry and Late Paleozoic climate. His professional activities include organizing numerous symposia, invited presentations, serving on editorial boards, and membership on the Internal Coordinating Committee of CHRONOS."

—Robert J. Stanton

Sandra Herbert, University of Maryland–Baltimore County

Elected to Fellowship as the 2006 GSA Mary C. Rabbitt History of Geology awardee.

Daniel K. Holm, Kent State University

"Daniel K. Holm is being recognized for his productive and innovative research on the tectonic and thermal history of continental crust, his success as a teacher, and his active participation in other activities within the profession."

—William R. Van Schmus

Randall J. Hunt, U.S. Geological Survey, Middleton, Wisconsin

"Randy Hunt is cited for his work on the role of groundwater in wetland processes, wetland restoration, and creation. He is also a leader in the groundwater modeling community, particularly in bridging finite difference modeling with analytic element modeling and the application of inverse models."

—Mary P. Anderson

Yukio Isozaki, University of Tokyo

"Yukio Isozaki is nominated for his revolutionary finding of fault-bounded thin chert-turbidite sequences in Japanese and many other accretionary complexes, new interpretation of tectonic evolution of Japan, identification of the oldest bacteria on Earth (3.5 Ga) in W. Australia, and the 'Plume Winter' hypothesis for Paleozoic-Mesozoic mass extinction."

—Juhn G.G. Liou

Jeffrey A. Karson, Syracuse University

"Jeffrey A. Karson, a structural geologist and tectonicist whose contributions are focused on understanding extensional and transform fault environments, ophiolite assemblages, and modern oceanic rift environments, has published 121 papers since 1978. He has been actively engaged in training young geologists, first at Duke University and currently at Syracuse University."

—Marion E. Bickford

Shu-Guang Li, Michigan State University

"Shu-Guang Li is nominated for GSA Fellowship because of his significant contributions in the fields of stochastic analysis and modeling of groundwater flow and contaminant transport in complex groundwater systems. Of particular interest is the modeling software Interactive Ground Water (IGW) that is well suited to enhancing learning about such topics."

—You-Kuan Zhang

Xian-hua Li, Guangzhou Institute of Geochemistry, China

"Xian-hua Li is nominated for a GSA Fellowship for his significant contribution to our understanding of the geodynamic evolution of the Western Pacific region, particularly through his excellent work on the petrogenesis of magmatic rocks in the South China region using isotope geochronology and geochemistry."

—Zheng-Xiang Li

Jian Lin, Woods Hole Oceanographic Institution

"Jian Lin is nominated as a GSA Fellow for his innovative, significant, and continuing contributions to the understanding of global ocean ridge processes and earthquake interactions."

—Yaoling Niu

Hui Hai Liu, Lawrence Berkeley National Laboratory

"Hui Hai Liu has used his broad interdisciplinary training to make fundamental contributions to variable density flow in porous media, fractal-based conceptualization of subsurface heterogeneity, flow and transport in unsaturated fractured rock, and, most recently, an understanding of scale-dependent matrix diffusion in fractured rock."

—Fred J. Molz

Mian Liu, University of Missouri–Columbia

"Mian Liu is nominated for his significant contribution to geodynamic modeling of geological and geophysical processes, including continental tectonics, mantle dynamics, magmatism, and metamorphism."

—Youxue Zhang

Kenneth G. MacLeod, University of Missouri–Columbia

"For engaging and innovative teaching across the curriculum and for innovative and scholarly research in the fields of paleoclimatology and mass-extinction events, Ken MacLeod is nominated for GSA Fellow."

—Carol M. Wicks

Peter J. Mehringer, Washington State University (retired)

Elected to Fellowship as the 2006 GSA Rip Rapp Archaeological Geology awardee.

Marli B. Miller, University of Oregon

"We recognize Marli Miller for her well-documented and beautifully illustrated publications on the geology of the Death Valley region, particularly the Black Mountains, and for her continued endeavor to increase public awareness of geology, especially through geophotography."

—Darrel S. Cowan

David R. Montgomery, University of Washington

Elected to Fellowship as the 2006 Kirk Bryan Award for Research Excellence recipient.

John W. Morse, Texas A&M University

"John W. Morse has defined the field of the physical chemistry of calcium carbonate in seawater and the controls on the carbonate compensation depth in the ocean. He has distinguished himself in the application of laboratory kinetic and thermodynamic data to the solution of important geologic problems."

—Fred T. Mackenzie

Tina M. Niemi, University of Missouri–Kansas City

"Tina M. Niemi applies her expertise in active tectonics and paleoseismology to evaluating earthquake hazards in California and the Middle East, where she also completes geoarchaeological studies that advance our understanding of interactions between human activities and natural events. She is currently serving as editor of *Geology*."

—Karen Grove

Nora Noffke, Old Dominion University

"Nora Noffke's studies of the earliest life on Earth have revealed a new group of sedimentary structures created by microbial mats in siliciclastic marine paleoenvironments. She is pioneer of the actualistic approach in studying early Archean life. If we find fossils on Mars, they will probably be Nora's microbial mats."

—Donald J. Swift

Lisa E. Park, University of Akron

"Nomination for excellence in lacustrine paleontology research, service to the Paleontological Society and GSA, cofounding of the GSA Limnogeology Division, public service for promoting the teaching of evolution in the classroom, the planning of college geology programs, and the encouragement of students."

—Elizabeth H. Gierlowski-Kordesch

Christopher J. Poulsen, University of Michigan

"For extraordinary accomplishment in combining climate model simulations with paleoceanographic and paleoclimatic data to achieve novel reconstructions of ancient climate and to improve understanding of the dynamics of climate change on Earth, in publication of the results of this important research, and in nurturing and training of young scientists."

—Philip A. Meyers

Karsten Pruess, Lawrence Berkeley National Laboratory

Elected to Fellowship as the 2006 O.E. Meinzer awardee.

Frank M. Richter, The University of Chicago

Elected to Fellowship as the 2006 Arthur L. Day medalist.

Benjamin J. Rostron, University of Alberta–Edmonton

"Ben Rostron has conducted seminal work on the hydrogeology of the sedimentary basins. His use of environmental isotopic tracers and fluid pressures to assess the formation of anomalous pressures and transient flow patterns is truly remarkable."

—Mark A. Person

Elizabeth J. Screaton, University of Florida

"Elizabeth Screaton is nominated for GSA Fellowship on the basis of her pioneering contributions in quantifying permeability, heat transport, and fluid flow within convergent margin systems. This work has provided key insights into the links between deformation, fluid pressure, and the earthquake cycle."

—Demian M. Saffer

Edward L. Simpson, Kutztown University

"Edward Simpson has made outstanding contributions to our understanding of Earth's history and to the training of the next generation of geoscientists. He has been especially successful at inspiring undergraduate college students to pursue field studies of sedimentary rocks."

—David B. Loope

Sigmund Snelson, Exploration consultant (retired)

"Sig Snelson's contributions to geology include major publications that have clarified understanding of the thin-skinned nature of the Appalachians and the existence of major alt nappes in the Gulf of Mexico. Additionally, he has encouraged publications from the private sector and has been active in AAPG and GSA community affairs."

—John H. Howard

Marios Sophocleous, Kansas Geological Survey

"Marios Sophocleous is recognized for his world-class research and leadership in areas of groundwater resource sustainability and recharge and vadose zone processes, and for his extraordinary record of service to the profession of hydrogeology."

—Frank W. Schwartz

Abraham E. Springer, Northern Arizona University

"Abe Springer has distinguished himself as an expert on groundwater flow in the Colorado Plateau and on the role of groundwater in sustaining wetland, spring, and stream ecosystems. He has rendered significant service to GSA and other professional organizations and has mentored numerous students."

—Alan E. Fryar

John P. Szabo, University of Akron

"John Szabo is a prominent glacial geologist with an extensive bibliography, particularly related to northern Ohio region. He has sustained contributions to both the professions and to the public. He chaired the most successful North-Central GSA [Section] Meeting both in quality and number of attendees at the University of Akron in 2006."

—L. Lynn P. Chyi

"John P. Szabo is an outstanding teacher, researcher, and administrator. During his years as a GSA Member since 1984 he has supported GSA and has participated in many GSA activities. John recently was chair of the outstanding and financially successful GSA North-Central Section Meeting in Akron, Ohio, in 2006."

—Robert F. Diffendal Jr.

Harold J. Tobin, University of Wisconsin–Madison

"Harold Tobin holds the unique position of co-chief project scientist for the Nankai Trough seismogenic zone experiment, which is arguably the most ambitious project ever attempted in marine geology. Tobin's interdisciplinary research expertise ranges from fault-zone dynamics to structural geology, borehole geophysics, and elastic-geotechnical properties of marine sediments."

—Michael B. Underwood

Ralf Topper, Colorado Geological Survey

Elected to Fellowship as the 2005 GSA E.B. Burwell Jr. awardee.

Thomas R. Watters, Smithsonian Institution

"Tom Watters has made significant contributions to the understanding of the tectonic history of Mars and Mercury. Using comparisons with terrestrial compressional features, as well as topographic and imaging data for the planets, his work has documented the role of large-scale compressional tectonism."

—Ted A. Maxwell

Gregory R. Wheeler, California State University–Sacramento

"Wheeler's research focuses on geoscience education and the geology of California. He teaches geology at the California State University, Sacramento, is their director of general education, improves the awareness of earth sciences in California schools, serves the National Association of Geoscience Teachers' (NAGT) programs, and advises the CSUS Foundation."

—Ian D. MacGregor

Steven F. Wojtal, Oberlin College

"Steven Wojtal is nominated to be a Fellow of GSA for his excellence in research and publication in the field of structural geology, his contributions to teaching and mentoring undergraduate students over three decades, and his service to the geologic community as an excellent reviewer and editor."

—Gautam Mitra

Salutations to GSA's 100-Year-Old Member

Senior Fellow **Victor Vacquier,** of La Jolla, California, will be celebrating his centennial this year. GSA extends its best wishes and proudly honors his 50-plus years of membership.

THE GEOLOGICAL SOCIETY OF AMERICA®

GSA Presidential Address & Awards Ceremony

Centennial Ballroom
Hyatt Regency Denver at Colorado Convention Center
Saturday, 27 October 2007, 7–9 p.m.

Reception to follow

THANKS FOR YOUR MEMBERSHIP!

THE GEOLOGICAL SOCIETY OF AMERICA®

GSA Celebrates New 50-Year Members for 2007

GSA salutes the following Members and Fellows for their 50-year membership to GSA. We appreciate their dedication and loyalty to GSA for all these years! The following lists only those Members and Fellows who are celebrating their 50-year membership anniversary in 2007. Asterisks indicate GSA Fellows.

John B. Adams*
Walter A. Anderson*
Clifford A. Balster*
Charles A. Baskerville*
William A. Bassett*
Edward Scudder Belt*
Milford J. Benham
William Alfred Berggren*
Charles W. Blount
Alfred E. Boerner
Harold F. Bonham Jr.*
Carl O. Bowin*
Allen S. Braumiller
John Dallas Bredehoeft*
Reginald Peter Briggs*
Henry S. Brown*
John George Cabrera*
John P. Crawford
Harry M. Dahl*
Hugh White Dresser
Norbert Edmund Faltyn
Oscar J. Ferrians*
William Lawrence Fisher*
Richard S. Fiske*
Pedro Antonio Gelabert*
Horace G. Goodell*
Philip Grubaugh
Richard D. Hagni*
William B. Hall*
William W. Hay*
C.R.B. Hobbs Jr.
Leslie Vincent Illing*
Herbert Orin Ireland*
Charles W. Jennings*
Blair F. Jones*
Paul F. Karrow*
John P. Kempton*
Frank H. Kilmer
Ross L. Kinnaman
James R. Kramer*
Dale Curtiss Krause*
Hulbert A. Lee*
Elroy P. Lehmann*
George W. Leney
Tom H.W. Loomis*
Charles F. Lough
James D. Lowell*
Edward T. Luther*
Richard J. Lutton
John Ross Mackay*
Lawrence E. Mannion
Alistair W. McCrone*
Donald Paul McGookey*
Andrew McIntyre*
Betty M. Tinklepaugh Miller*
Steven D. Mitchell
Ralph Moberly*
John D.A. Mollard*
Cherukupalli E. Nehru*
Arthur E. Nelson*
Richard L. Nielsen*
Matthew H. Nitecki*
John S. Owens
Russel A. Peppers*
Ralph M. Perhac*
Lucian B. Platt*
James C. Ratte*
Charles B. Reynolds
James A. Roddick*
Frank Royse*
Meyer Rubin*
Henry Philip Schwarcz*
Eugene M. Shearer
Barry D. Shelkin
Richard A. Sheppard*
Betty Ann Lindberg Skipp*
James Edward Slosson*
James Donaldson Smith*
Archibald M. Stalker*
Jean-Daniel Stanley*
John Harris Stewart*
Rowland W. Tabor*
Manik Talwani*
William H. Taubeneck*
Spencer R. Titley*
James R. Underwood Jr.*
Joseph A. Vance*
Glenn S. Visher*
Roland von Huene*
John R. Wilson
John W. Winchester
Donald U. Wise*
Robert S. Yeats*
Lynn A. Yehle

GSA Celebrates 25-Year Members for 2007

GSA salutes the following Members and Fellows for their 25-year membership to GSA. We appreciate their dedication and loyalty! The following lists only those Members and Fellows who are celebrating their 25-year membership in 2007. Asterisks indicate GSA Fellows.

Mark E. Ander
Craig M. Ashbrook
Brian F. Atwater*
William I. Ausich*
Palmer K. Bailey
Edward A. Banaszek Jr.
William S. Bartels
Mark D. Barton*
Mark A. Beeunas
Thomas M. Berg*
David A. Bero
Bruce J. Bilodeau
Robert P. Blauvelt
Paul J. Boison
Samuel A. Bowring*
Austin E. Boyd
G. Robert Brakenridge*
Patrick W. Brock
Robert A. Brozdowski
Arthur B. Busbey
Steven K. Campbell
Michael L. Capps
Michael C. Carpenter
Stephen J. Carter
Kerry D. Cato*
C. Blaine Cecil
Erica Bratman Cerny
Habte Giorgis Churnet
Millard F. Coffin
David G. Coles
Radu R. Conelea
Douglas E. Connell
Marc R. Connolly
Susan Howes Conrad
Mark N. Corbett
John P. Craddock*
Robert E. Crippen
Stanley L. Cunningham
Matthew Davidson
Garrett A. Day
David A. Dellinger
Justin V. Devery
William J. Devlin
Douglas B. Dickey
Tammy Dickinson
John A. Diemer
Yildirim Dilek*
David R. Dockstader
Clifford H. Dodge
David J. Doherty
Anna M. Domitrovic
Robyn Wright Dunbar

You'll find a complete list of Members and Fellows who have surpassed the 50-year mark at www.geosociety.org/grants/.

Visit GSA's 2007 Annual Meeting **Hall of Fame** at the Colorado Convention Center 26 October through 31 October to view larger-than-life banners honoring the new 25- and 50-year Members (celebrating their anniversaries this year), and be sure to congratulate those you might see at the meeting!

25-Year Members (*continued*)

Ronald J. Echols
Allan A. Ekdale
Edward D. Elkins
Dale L. Erlandson
Karl V. Evans
Carol A. Evenchick*
James E. Faulds
Malcolm S. Field
Michael A. Fisher*
Raymond C. Fletcher
Andrew J. Flurkey
Jeffrey Y. Foley
John H. Fournelle
John M. Fowler
Grant Garven*
Alexander E. Gates*
John W. Geissman*
Michael J. Gerdenich
Richard G. Gibson
Gary H. Girty*
Stephen C. Godfrey
Laurel Pringle Goodell
John W. Goodge*
John P. Grotzinger*
Anne M. Grunow*
Ann I. Guhman
Bruce Handley
Vicki L. Hansen*
Tekla A. Harms*
Ronald A. Harris
Richard T. Haworth*
Lynn D. Haynes
Friedrich Heller
Zoltan Hershkowitz
Beverly L. Herzog
Julie K. Hewlett
Gregory T. Himes
Kurt C. Hinaman
Charles W. Hoffman
John P. Hogan*
Thomas D. Hoisch
David S. Holland
Wendel J. Hoppe
Stephen D. Hurst
Barbara E. John*
Norvel R. Johnson
Theodore D. Johnson
Richard A. Kerr*
Richard M. Kettler
Kathryn C. Kilroy
In-Soo Kim
James A. Kipp
Margaret A. Klute
William S. Kowalik
Bart J. Kowallis*
T. Matthew Laroche
Robert A. Larson*
Timothy F. Lawton*
Aaron R. Liesch
Enrique Linares
Steven R. Lipshie
Thomas J. Lochen
Allen Lowrie
Allan Ludman*
Karen Lund
John H. Lyle
Greg H. Mack*
Harmon D. Maher Jr. *
Micheal R. Maitland
Jon J. Major*
Bernard Markunas
David J. Marsh
Stephen J. Martel*
Robert G. Marvinney*
Larry G. Mastin
Jeffrey A. May
James P. McCalpin
Charles Merguerian
Peter M. Mesard
Ellen P. Metzger
Fredrick W. Metzger
Christopher V. Metzler
Kimberlee W. Millberry-Horan
Grant F. Miller
Kenneth G. Miller*
Zoeb Mogri
Joachim Mohn
John T. Morehouse
Cary L. Mrozowski
Raymond G. Mueller
Samuel B. Mukasa*
Rosalind Munro
C.H. Murrish
R. Damian Nance
William E. Nellist
Gregory A. Nethery
Jay S. Noller
Constance J. Nutt
Jean M. Olson
Glenn R. Osburn
Karl S. Osvald
George Ross Pafumi
Terry L. Pavlis*
English C. Pearcy
Lucille A. Piety
John C. Pitlick
David Ray Potter
Lee S. Potter
Anthony R. Prave
Wayne R. Premo
Libby M. Prueher
Ernest R. Rahaim
Kelvin W. Ramsey
Mark K. Reagan
Margaret N. Rees*
Stephen J. Reynolds*
James G. Rigby
Nancy Riggs
John B. Ritter
Michael R. Rosen
Roberta L. Rudnick*
Joaquin Ruiz*
Margaret E. Rusmore*
Delfino C. Ruvalcaba-Ruiz*
Paul T. Ryberg
H. Sakai
James P. Salisbury
George J. Saucedo
Andrew D. Schedl
Paul G. Schmidt*
Joel D. Schneyer
David Alan Schroeder
Patricia O. Seaward
John N. Seitz
James R. Shannon
Albert W. Shultz
Bruce S. Sibbett
Gary B. Sidder
Bruce M. Simonson*
Robert Smalley
Cathlee Smith
Janet M. Sowers
Joann M. Stock
Shiro Tamanyu
Vatche P. Tchakerian
Jeffrey H. Tepper
Stephen M. Testa*
Robert D. Townsend
Kathy Goetz Troost*
Stephen J. Urbanik
Ben A. van der Pluijm*
David A. Vanko
Nancy D. Vaughan
Jan Veizer*
Timothy J. Vogt
Lloyd L. Wall
Wesley K. Wallace
Mary-Camilla Wallis
Lynn M. Walter*
Amy Schoner Wandless
David B. Ward
Michael Fred Weber
Bruce S. Wedgeworth*
Rodney J. Weick
James L. Welsh
Craig M. White
Don A. Williamson
Grant C. Willis
Laurence M. Wilson
Michael B. Winter
Michael A. Wise
Richard D. Woodsmith
Michael A. Young
Robert W. Zei
Peter K. Zeitler
Robert A. Zielinski
Edward J. Zofchak

GSA Fellows!

If you see the names of deserving Members on these lists who have yet to be elevated to GSA Fellowship, please follow up on your duty to nominate these deserving geoscientists. Keep GSA Fellowship strong and vibrant by sending in your nominations today!

Guidelines and nomination forms are at www.geosociety.org/members/fellow.htm. Questions? Please e-mail awards@geosociety.org or call +1-800-472-1988 ext. 1028 or +1-303-357-1028.

2007 GSA RESEARCH GRANT RECIPIENTS

The GSA Committee on Research Grants met at GSA Headquarters in Boulder, Colorado, on Saturday, 24 March 2007, and awarded US$529,188 to 246 graduate students. The committee also selected ten alternate candidates in the event that any grantees return all or part of their funds due to a change in their research project or receipt of funds from another source. The eighteen committee members for 2007 were Bruce Simonson (Chair), Laurie Brown, Allen Dennis, Katherine Cashman, Amy Draut, Andrew Gombos, Stephen Harlan, Hope Jahren, Vincent Matthews, Joseph Meert, Lina Patino, Lisa Pratt, Dibyendu Sarkar, Sheila Seaman, Mark Steltenpohl, Lisa Stillings, Sally Sutton, and Timothy White.

2007 Student Research Grant Statistics

Total proposals received	474
Total proposals funded	246
Total dollars awarded	US$529,188
Average award	US$2,151

2007 Partial List of Funding Sources
(all funds are in U.S. dollars)

Joseph T. Pardee Memorial Fund	$235,000
Partial GSA Funding	**$235,000**

Geophysics Division (to augment Cox Award)	$1,050
Sedimentary Geology Division Award	$1,000
Structural Geology and Tectonics Division Award	$3,600
Geophysics Division Grant	$250
Total Division Funding	**$5,900**

Total National Science Foundation Funding*	**$173,900**

2007 Partial GSA Foundation Funding

Harold T. Stearns Award Fund	$3,000
Lipman Fund	$5,500
Blechschmidt Award	$1,100
Cox Award (Geophysics Division)	$1,200
Dillon Alaska Award	$2,800
Reed Research Award	$1,900
Sisson Research Award	$2,300
Minority Fund	$1,900
Hydrogeology Division Award	$2,500
Montagne Fund	$600
Research Fund	$6,000
GeoStar	$8,800
Curtis Fund	$5,000
Ross Fund	$4,800
Wanek Fund	$3,000
Snavely	$1,500
Unrestricted	$53,500
Terman (to be awarded in October)	$5,000

*NSF grant matched at least two to one by GSA and GSA Foundation.

Outstanding Mention 2007

The committee recognized 20 of the proposals to be of exceptionally high merit in conception and presentation.

❖

- **Zachary S. Casey,** University of Kansas, for "The Cerro Coso fault, a study of strain transfer across the Garlock fault, southeastern California."
- **William E. Childers,** University of California at Los Angeles, for "Drainage and morphological development of the Santa Monica Mountains and its implications for paleoseismicity in the greater Los Angeles area."
- **Kristen L. Cook,** Massachusetts Institute of Technology, for "Cenozoic normal faulting on the eastern margin of the Tibetan Plateau."
- **Colin Cooke,** University of Alberta, for "Lake sediment reconstructions of atmospheric mercury pollution from the South American Andes."
- **Nicole L. Cox,** Brigham Young University, for "Quaternary sea-level and tectonic uplift patterns revealed from emergent coral terraces of Timor-Leste."
- **Amalia Doebbert,** University of Wisconsin–Madison, for "U/Pb and Hf isotope provenance of detrital zircons from the Gualala Basin, California."
- **James M. Eros,** University of California at Davis, for "Major late-Paleozoic climate transitions in paleotropical records: Donets Basin, Ukraine."
- **Elizabeth M. Fein,** Kent State University, for "Flow fabric determination of two Mesoproterozoic midcontinent rift dike swarms, northeastern Minnesota."
- **Logan Hansen,** Montana State University, for "Experimental studies using supercritical CO_2 to challenge brine aquifer reservoir rocks from the Powder River Basin, WY and SD."
- **Katherine Johanesen,** University of Southern California, for "Thermal signatures of incremental pluton emplacement in the host rock: Application to the Fangshan Pluton, China."
- **Jackie Langille,** Central Washington University, for "A geologic test of a middle crustal channel flow model; Mabja Dome, southern Tibet."
- **Leila Marzeki,** University at Buffalo–SUNY, for "Tracking lava lake fluctuations at Villarrica Volcano, Chile."
- **Scott A.D. McBride,** University of Arizona, for "Basin analysis and tectonic setting of the Salta Rift, NW Argentina."
- **Shahnewaz Mohammad,** University of Nevada–Reno, for "Geochemical cycling of naturally occurring arsenic in the Humboldt River Basin (HRB), northern Nevada."
- **Rachel Potter,** University of Maryland, for "Diffusion of oxygen and lithium isotopes at a contact between the Bushveld and metasediments: Implications for diapiric rise of the Phepane Dome."
- **Kevin D. Robinson,** University of Pittsburgh, for "The validation of diffuse reflectance spectroscopy as potential chlorophyll—an indicator in northern Mongolian lake sediments."
- **Erik A. Sperling,** Yale University, for "Homology of biomineralization in the *Lophotrochozoa*."
- **Elizabeth K. Thomas,** University of Buffalo–SUNY, for "Global warming in light of past millennia: A multiproxy lacustrine study of climate in northeastern Arctic Canada."
- **John E. Volkmer,** University of Arizona, for "Uplift in central Tibet prior to the Indo-Asian collision?"
- **Melissa Wolfe,** University of Kansas, for "Calibration of rutile (U-Th)/He thermochronology: Assessing the thermal evolution of the KTB drill hole, Germany and adjacent Bohemian Massif."

2007 Specialized Awards

The committee selected recipients of the specialized awards named in honor of the donors or as memorials to former Society Members.

❖

GRETCHEN L. BLECHSCHMIDT AWARD

The Gretchen Louise Blechschmidt Award Fund was established for women in the geological sciences who have an interest in achieving a Ph.D. in the fields of biostratigraphy and/or paleoceanography; sequence stratigraphy analysis, particularly in conjunction with research in deep-sea sedimentology; and a career in academic research. The 2007 recipient is **Lauren C. Neitzke,** Rutgers University, for "Variations in the vertical structure of the ocean over the past 18 kyr on Eirik Drift: Implications for climate and ocean circulation."

JOHN T. DILLON ALASKA RESEARCH AWARD

The John T. Dillon Alaska Research Award is in honor of the memory of Dillon, who was particularly noted for his radiometric age-dating work in the Brooks Range, Alaska. Two areas that serve as guidelines for selection of the awardee are field-based studies dealing with the structural and tectonic development of Alaska and studies that include some aspect of geochronology (either paleontologic or radiometric) to provide new age control for significant rock units in Alaska. The 2007 recipient is **Michael Howley** of the University of New Hampshire for "A Holocene glacial chronology from the central Alaska Range using in situ-produced cosmogenic Be-10 and C-14."

ROBERT K. FAHNESTOCK AWARD

The Robert K. Fahnestock Award honors the memory of Fahnestock, a former member of the Research Grants Committee, who died indirectly as a result of service on the committee. The grant is awarded for the best proposal in sediment transport or related aspects of fluvial geomorphology, Fahnestock's field. The 2007 recipient is **Daniel D. Cadol** of Colorado State University for "Wood loading in neotropical forested headwater streams."

LIPMAN RESEARCH AWARD

The Lipman Research Fund was established in 1993 and is supported by gifts from the Howard and Jean Lipman Foundation. The purpose of the fund is to promote and support student

research grants in volcanology and petrology. The president of the Lipman Foundation, Peter W. Lipman, was the recipient of a GSA research grant in 1965. The 2007 recipient is **Daniele McKay** of the University of Oregon for "Explosive basaltic eruptions in arc and backarc settings."

BRUCE L. "BIFF" REED SCHOLARSHIP AWARD

The Bruce L. "Biff" Reed Scholarship Fund was established to provide research grants to graduate students pursuing studies on the tectonic and magmatic evolution of Alaska primarily, and also can fund other geologic research. The 2007 recipient is **Daniel Shugar** of Simon Fraser University for "Large catastrophic landslides onto glaciers, Alaska Range and St. Elias Mountains."

ALEXANDER SISSON RESEARCH AWARD

Family members of Alexander Sisson established a fund in his memory to promote and support research by students pursuing studies in Alaska and the Caribbean. The 2007 recipient is **Jill Leonard-Pingel** of the University of California at San Diego for "The dissection of an extinction: Using ecology to understand the Neogene Caribbean extinction."

HAROLD T. STEARNS FELLOWSHIP AWARD

Harold T. Stearns established this Fellowship Award in 1973 for student research on aspects of the geology of the Pacific Islands and the circum-Pacific region. This year, the committee presented the award to three candidates. They are **Eric Gottlieb** of New Mexico State University for "Testing a model for synextensional magmatism and migmatite generation, Bendeleben Mountains, Seward Peninsula, Alaska"; **Natalia Pardo** of Universidad Nacional Autónoma de México (UNAM) for "Stratigraphy and eruptive history of the Asososca Maar, Nicaragua"; and **Melissa Sabga**, of the University of Idaho for "Implications of temporal-compositional variations in the Pajas Flow, Floreana Volcano, Galápagos Islands."

JOHN MONTAGNE FUND

The John Montagne Fund was established in 2000 to support one recipient's research in the field of quaternary geomorphology. The 2007 recipient is **Ryan Crow** of the University of New Mexico for "Interactions between volcanism, river incision, and normal faulting in western Grand Canyon and implications for neotectonic models of the area."

ALEXANDER & GERALDINE WANEK FUND

The Wanek Fund was established in 2002 to support research dealing with coal and petroleum resources, mapping, and engineering geology, marine resources, petroleum economics, appraisal, and evaluation, and the geology of phosphate resources. The 2007 recipient is **Jorge E. Marino** of the University of Illinois at Urbana–Champaign for "Geothermal conditions in the Illinois Basin at the time of coalification."

CHARLES A. & JUNE R.P. ROSS RESEARCH FUND

The Ross Research Fund was established in 2002 to support research in the fields of biostratigraphy (including, but not limited to, fossil age dating and the study of evolutionary faunal successions), stratigraphy and stratigraphic correlation, paleogeography and paleobiogeography, interpreting past environments of deposition and their biological significance, and the integration of these research areas into better global understanding of (1) past plate motions (plate tectonics and seafloor spreading); (2) past sea-level events, including their identification and ages; and/or (3) climate changes and effects of those climate changes on Earth's inhabitants through geologic time. There should be, over time, a balance of money among the awards across these various subject sub-field categories depending on the merit of the annual project proposals. The 2007 recipient is **Paul E. Reyerson** of the University of Wisconsin–Madison for "Measuring the response of central Great Plains paleovegetation to Holocene climate change: The applicability of biogenic silica."

PARKE D. SNAVELY, JR., CASCADIA RESEARCH AWARD FUND

The Parke D. Snavely, Jr., Cascadia Research Award Fund provides $1500 to support field-oriented graduate student research that contributes to the understanding of the geologic processes and history of the Pacific Northwest convergent margin or to the evaluation of its hazard or resource potential. The 2007 recipient is **Nicole E. Moore** of Western Washington University for "Origin and geochemical evolution of primitive mafic magmas, Mount Baker, Washington: Probes into mantle and crustal processes."

THE MAURICE "RIC" TERMAN FUND

The Maurice "Ric" Terman Fund provides one-year grants to fund the Ph.D. theses and post-doctoral research of East Asian scientists. The countries currently included in this category are Cambodia, China, Indonesia, Japan, Korea, Malaysia, Papua New Guinea, Thailand, and Vietnam. A recipient will be chosen in the fall of 2007.

The **Outstanding Mention** recipients as well as the **Specialized Award** recipients will be formally recognized by GSA at the President's Student Breakfast at the 2007 GSA Annual Meeting in Denver on Sunday, 28 October, 7–8:30 a.m. At that time, certificates and ribbons will be presented to the students.

Division Awards

Five Divisions have recognized the following grant recipients who submitted proposals of exceptionally high merit in conception and presentation in their fields. These students will receive recognition at their respective Division's award reception at the 2007 GSA Annual Meeting in Denver.

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GEOPHYSICS DIVISION

Allan V. Cox Student Research Grant

- **Matthew S. Zechmeister,** University of Oklahoma, for "Paleomagnetic and rock magnetic study of Lower Carboniferous carbonates in NW Montana and SW Alberta with implications for orogenic remagnetization."

Geophysics Student Research Grant Award

- **Jack S. Grow,** University of New Mexico, for "Defining the eastern and southern boundaries of the central Walker Lane Belt extensional complex: A paleomagnetic approach."

HYDROGEOLOGY DIVISION

Hydrogeology Division Student Research Grant Awards

- **Kamala Brown,** California State University–Sacramento, for "Physical and hydrological characterization of the Clark Meadow, California."
- **Drew B. Gower,** University of Wisconsin, for "Seepage quantification and modeling of reservoir contribution to groundwater levels in the Nariarlé basin of Burkina Faso."
- **Jeff Phillippe,** Oregon State University, for "Glacier meltwater contributions to the Upper Hood River, OR, and a model for future runoff.
- **Rob A. Venczel,** Southern Illinois University–Carbondale, for "Historical trends in flow dynamics and flood magnification, Tisza River, Hungary."
- **Corinne Wong,** University of Texas at Austin, for "Evaluating impacts of brush removal on recharge of a karst aquifer."

QUATERNARY GEOLOGY AND GEOMORPHOLOGY DIVISION

J. Hoover Mackin Student Research Awards

- **Nicholas L. Balascio,** University of Massachusetts, for "Holocene tsunami deposits in coastal lakes of the Lofoten Islands, northwestern Norway."
- **Eli Lazarus,** Duke University, for "A possible explanation for the locations and behavior of erosional hotspots on the northern Outer Banks, North Carolina."

Arthur D. Howard Student Research Award

- **Caleb J. Schiff,** Northern Arizona University, for "Climate reconstruction from diatom oxygen isotopes, Prince William Sound, Alaska."

Arthur D. Howard Student Research Award Honorary Mention

- **Elizabeth K. Thomas,** University at Buffalo–SUNY, for "Global warming in light of past millennia: A multiproxy lacustrine study of climate in northeastern Arctic Canada."

SEDIMENTARY GEOLOGY DIVISION

Sedimentary Geology Division Student Research Grant Award

- **Dolores A. van der Kolk,** University of Alaska–Fairbanks, for "Sedimentology, stratigraphy, and paleoenvironmental reconstruction of the pebble shale unit within the Northeast Brooks Range, Alaska."

STRUCTURAL GEOLOGY AND TECTONICS DIVISION

Structural Geology and Tectonics Division Student Research Grant Awards

- **Sara M. Smaltz,** Colorado State University, for "Structural controls on detachment folds associated with foreland arches: Beaver Creek anticline, Wyoming."
- **Daniel Jones,** University of Wyoming, for "Analysis of Paleoproterozoic growth along the southern margin of Laurentia, Sierra Madre, southeastern Wyoming."
- **Ephrain A. Taylor,** University of Texas at Austin, for "Structural kinematics, fluid flow, and talc formation in the Allamoore Talc District, West Texas."

THE GEOLOGICAL SOCIETY OF AMERICA®

2007 GSA RESEARCH GRANT RECIPIENTS

A

Jennifer Abrahamson
Jason Adams
Katherine Adelsberger
Henry Agbogun
John Allen
Jonathan Allen
Heather Anderson
Syam Sundar Andra
Jourdan Anoka
Wasinee Aswasereelert

B

Nicholas Balascio
Iain Barton
Arden Bashforth
Keith Beisner
Scott Bennett
Jeff Benowitz
Melanie Bergolc
Anne Bernardt
Marc Bernstein
Paul Betka
Philip Bottrell
Mark Bowen
David Bridges
Connie Brown
Kamala Brown
Kenneth Brown
John Buchanan

C

Daniel Cadol
Margaret Cagle
Matthew Carter
Zachary Casey
Jasmin Caton
Devapriya Chattopadhyay
Jeff Chaumba
Greg Chavdarian
Lauren Chetel
William Childers
Brian Clarke
James Clements
Kristopher Clemons
Kristen Cook
Colin Cooke
Raymond Cooley
Brian Cosky
Nicole Cox
Shelley Crausbay
Raymond Bart Critser
Ryan Crow
Adam Csank

D

Jennifer DeLoge
Germari de Villiers
Amalia Doebbert
Kirk Domke
Vanessa Drueke
Jessica Duggan
Inmaculada Dura-Gomez

E

Rita Economos
Douglas Edmonds
Amy Ellwein
Stephen Elmore
Daniel Emiliano
Emerald Erickson
James Michael Eros
Jaime Escobar

F

Majie Fan
Una Farrell
Elizabeth Fein
Peter Flaig
Andrew Flor
Brady Foreman
Rebecca Franklin

G

Richard Gaschnig
Esteban Gazel Dondi
Andrew Gendaszek
Jennifer Gifford
Cyrus Gillett
Tom Gleeson
Sally Goodman
Emily Gottesfeld
Eric Gottlieb
Drew Gower
Sarah Greene
Tanya Gregg
Jack Grow
Melanie Grubb
Frank Guerrero
Erik Gulbranson

H

Logan Hansen
Kelli Hardesty
Nathan Harris
Alexander Hastings
Lindsey Henry
Alan Hidy
Markella Hoffman
Michael Howell
Michael Howley
Leslie Hsu

I

Gabriel Izsak

J

Trisha Jackson
Debra Jennings
Katharine Johanesen
Bradley Johnson
Elizabeth Johnson
Daniel Jones

K

Susan Karberg
Christopher Kassel
Claire Kaufman
Dawn Kellett
Andrew Kemp
Peter Knappett
Ozgur Kozaci
Branden Kramer

L

Julia Labadie
Aurele LaMontagne
Jackie Langille
Tiffany Larsen
Catherine Lash
Rachel Lauer
Samanta Lax
Eli Lazarus
Daniel Lazzareschi
Jill Leonard-Pingel
Kevin Lielke
Christopher Lipinski
Ashley Long
Sean Loyd
Yuehan Lu

M

Matthew Machusick
Kaitlin Clare Maguire
Sara Maloney
Jorge Marino
Wayne Marko
Antonios Marsellos
Pamela Marsh
Leila Marzeki
Joshua Mathews
Scott McBride
Seann McClure
Daniele McKay
Melanie Michalak
Lauren Michel
Shahnewaz Mohammad
Robert Moniz
Nicole Moore
John Morkeh
Ryan Moyer
Christopher Myrvold
Kristen Myshrall

N

Travis Naibert
Lauren Neitzke
Daren Nelson
Nathan Nelson
Brian Nicklen
James Nolan

O

Hollie Oakes-Miller
Paul Oliver
Christina O'Malley
Stephen Osborn
Shannon Othus

P

Natalia Pardo
Hyunmee Park
Camille Partin
Stephanie Peek
Stephanie Perry
Lyman Persico
Aurel Persoiu
Jeff Phillippe
Jason Polk
John Porter
Rachel Potter
Eric Prokocki

Q

Ursula Quillmann

R

Mohammad Rahman
Jasmin Raymond
Rebecca Reverman
Paul Reyerson
Amy Rice
William Rittase
Colin Robins
Kevin Daniel Robinson
Teresa Russin

S

Melissa Sabga
Kimberly Samuels
Rory San Filippo
Veronica Sanchez
John Sarao
Mitchell Scharman
Caleb Schiff
Kathryn Schreiner
Holly Schultz
Alan Shabel
Ryan Shackleton
Erin Shea
Emily Short
Daniel Shugar
Joshua Sigler
Sheldon Skaggs
Sara Smaltz
Adam Smith
Limaris Soto
Erik Sperling
Abby Springer
Kevin Stafford
Michael Stearns
Byron Steinman
Dariusz Strapoc
Mel Strong
Marina Suarez
Eugene Szymanski

T

George Tangalos
Ephraim Taylor
Joshua Theule
Elizabeth Thomas
Cara Thompson
Skye Thomson
Kate Tierney
Abbie Tingstad
Denitsa Toneva
Lisa Tranel
Joanna Troy
Craig Tully
Carrie Tyler

V

Dolores van der Kolk
Peter van Hengstum
Charuleka Varadharajan
Claudia Velez
Rob Venczel Hasley
Vincent John Volkmer
Rachael Von Mann

W

Yiming Wang
Christopher Ward
Shalina Warrior
Amelinda Webb
Nicole West
Isaac Westfield
John Whitlock
Luke Wilson
Melissa Wolfe
Corinne Wong
Jennifer Wright

Y

Nicolas Young
Seth Young
Huimin Yu

Z

James Zambito
Matthew Zechmeister
Tao Zhang
Guangsheng Zhuang
Joseph Zullo

Selected Alternates for 2007

Derek Adams
Karen Carroll
Jeremy Gouldey
Bethiah Hall
Andrew Haveles
Christopher Hein
Jennifer Kelley
Joshua Long
Kathryn Snell
Edward Sweeney

2007 Gladys W. Cole and W. Storrs Cole Memorial Research Awards

Martha Cary Eppes, of the University of North Carolina at Charlotte, was awarded US$8,600 from the Gladys W. Cole Fund for research in geomorphology of semi-arid and arid terrains for her research project "The weathering of marble grus and corestones."

Benjamin P. Horton, of the University of Pennsylvania, was awarded US$7,600 from the W. Storrs Cole Fund for research in invertebrate micropaleontology for his research project "Examining the evidence for a recent acceleration in the rate of sea-level rise using combined instrumental and proxy data, Morbihan Golfe, Brittany, France."

The 2007 Cole Awards for postdoctoral research are funded by the GSA Foundation.

New Student Research Fund Established

With great pleasure, GSA Foundation announces the establishment of the **Farouk El-Baz Student Award** to encourage and promote desert research in the broadest sense. About the award, El-Baz says, "Deserts have received far less attention than other types of landforms in geological studies. This award will encourage more students to pursue investigations of arid lands, which constitute over one-third of the land surface of our planet."

The Qatar Foundation for Education, Science and Community Development generously provided the initial endowment sum of US$100,000. The award will provide up to one male and one female student a US$2,500 award each, based on a summary of proposed research and an advisor recommendation.

The **Qatar Foundation** is a private, chartered, nonprofit organization. It was founded in 1995 by the Emir of the State of Qatar to develop centers for progressive education, research, and community welfare. It is chaired by H.H. Sheikha Mozah Bint Nasser Al-Missned, consort of the Emir of Qatar.

El-Baz, a veteran of the National Aeronautic and Space Administration's Apollo program, is research professor and director of the Boston University Center for Remote Sensing. He is renowned for pioneering research in the applications of satellite images to study deserts worldwide, with emphasis on the location of groundwater resources. El-Baz is a GSA Senior Fellow, a current member on the GSA Foundation's Board of Trustees, and member of the U.S. National Academy of Engineering, for which he serves on the committee to identify "Grand Challenges for Engineering" in the next century.

In 1999, GSA Foundation established the "Farouk El-Baz Award for Desert Research," to award excellence in arid land studies. An annual distribution of US$10,000 has been awarded to leading experts in desert research from the international scientific community. The new award is designed to encourage students to enter the field of desert study.

For further information on the El-Baz Student Research Fund, please go to gsafweb.org.

Charitable IRA Rollover

Time is growing short for you to take advantage of the Pension Protection Act of 2006 (PPA). The PPA may offer an opportunity to those at least 70 and a half years old to make tax-free charitable gifts from potentially taxable individual retirement account (IRA) funds. Please check with your financial planner to see if you qualify. This charitable-giving window closes 31 December 2007.

For additional information on transferring funds, please contact the GSA Foundation, drussell@geosociety.org, +1-303-357-1054.

Most memorable early geologic experience:

Long, hot Utah field days. Stand up—dizzy! Sit—dizzy! Exhaustion! Nausea! Couldn't drink! What helped? Soda crackers. A lesson learned (salt deficiency) and not forgotten.

—Paul H. Reitan

GSA FOUNDATION
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25 YEARS

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+1-303-357-1054
drussell@geosociety.org

www.gsafweb.org

Enclosed is my contribution in the amount of $_____.

Please credit my contribution for the:

☐ Farouk El-Baz Student Research Fund

☐ Greatest need ☐ Other: _____ Fund

☐ I have named GSA Foundation in my will.

PLEASE PRINT

_____
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_____
City/State/ZIP

_____
Phone

GSA COMMITTEES: PROGRESS THROUGH SERVICE

Awards Committees

The Geological Society of America is a large and diverse group of extraordinary scientists. Our membership has not only grown over the years, but diversified, expanding into new disciplines that include all aspects of Earth, our solar system, and beyond. Every year we hear new research presented at Society and other meetings and read it not only in GSA publications but in journals published throughout the world. It is a tremendous thrill when we are exposed to groundbreaking science that impacts our thinking in many and varied ways.

It is only fitting that the Society has established awards to recognize the exceptional contributions of scientists, ranging from those at early stages in their careers to those who have made a lifelong impact. The awards are not only a way to congratulate those scientists who stimulate our thinking, but also to offer our thanks.

THE THREE SOCIETY MEDALS

We can all be inspired and excited by the creative and multidisciplinary advances of young geoscientists. A very generous endowment to the Society in 1988 by Dr. and Mrs. Fred Donath generated the newest medal for GSA, the Donath Medal, also known as The Young Scientist Award. This award is presented to a scientist age 35 or younger for outstanding achievement in contributing to geologic knowledge through original research that marks a major advance in the earth sciences. This award has personal meaning for me because when I took structural geology at Stanford some years ago, Fred Donath was the teaching assistant. I have served on this award committee several times and am always amazed by the extraordinary accomplishments of our young members. This bears witness to the health and vitality of GSA.

The Arthur L. Day Medal is awarded 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 to inspire further effort in scientific discovery and elucidation.

The Penrose Medal, the highest GSA award, is presented in recognition of eminent lifelong research in pure geology, for outstanding original contributions, or for achievements that mark a major advance in the science of geology. Reading through the list of past Penrose medalists (www.geosociety.org/awards/past.htm#penrose) is truly a walk through the history of scientific advancement.

Other Major Society Awards

The GSA Public Service Award (www.geosociety.org/aboutus/awards/aboutAwards.htm#psa) was established by Council in 1998 in honor of Eugene and Carolyn Shoemaker (www2.jpl.nasa.gov/sl9/news81.html). This award honors individuals who have significantly enhanced public understanding of the earth sciences. In this age of rapidly expanding scientific knowledge coupled with high-stakes public policy issues, GSA recognizes the vital importance of outstanding achievement in communicating science.

Honorary Fellowship is the Society's oldest homage, established by Council in 1909 to honor individuals who have lived and developed their careers outside of North America and made outstanding and internationally recognized contributions to our science. Honorary Fellows (usually one to three each year) are granted lifetime membership in GSA. North Americans also have been named Honorary Fellows for notable service to the Society, but rarely, as the recognition is meant to focus on the international community.

NOMINATION AND SELECTION OF HONOREES

Identifying the most qualified scientists for these awards requires a proactive membership to nominate worthy candidates. This entails the small but necessary effort of providing a statement of qualification (300 words or less) and supporting documentation that includes a biographical outline, limited bibliography, and several supporting letters. Each award requires specific information, which can be found on the GSA Web site at www.geosociety.org/awards/nominations.htm.

Committees for each award consider the nominations and select awardees. Each committee's final ranked list of candidates is evaluated and approved by Council.

GSA members serve on and chair these committees. Because of the diversity of our science, members from many disciplines are needed to adequately evaluate the candidates. Any Society member can volunteer to serve on these committees, but final selection of committee members varies each year depending upon the expertise needed.

I have served on all of the award committees, either as a member or chair, sometimes more than once, and have never found the committee work to be too time consuming. Rather, it is a pleasure to be able to make a small contribution to those members of our Society who have contributed so much to all of us.

Clark Burchfiel
Massachusetts Institute of Technology, bcburch@mit.edu
Past Chair, Young Scientist Award Committee (2005–2007); committee member through 30 June 2008.

You can volunteer to serve on an award committee or nominate someone you know who would fit well with the mission of these committees. ***See page 29 to find out how (and hurry: the deadline is 15 July!).***

To read more about the awards, go to www.geosociety.org/awards/aboutAwards.htm.

The Kerry Kelts Research Awards of the Limnogeology Division

APPLICATION DEADLINE: 10 AUGUST 2007

The application process for the Kerry Kelts Research Awards of the Limnogeology Division is now open. These awards are named in honor of Kerry Kelts, a visionary limnogeologist and inspiring teacher. Up to three awards of US$350 each for use in research related to limnogeology, limnology, and paleolimnology are available. Application for this award is simple and consists of a summary of the proposed research, its significance, and how the award will be used (five-page *maximum*). Please send your summary in PDF format along with your name and associated information to the chair of the Limnogeology Division, Kevin M. Bohacs, **kevin.m.bohacs@exxonmobil.com.**

Awards will be announced in October at the Limnogeology Division Business Meeting and Reception at the 2007 GSA Annual Meeting in Denver.

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

Call for GSA Committee Service

Stimulate Growth and *Change*

Serve on a GSA Committee!

2008–2009 COMMITTEE VACANCIES

Terms begin 1 July 2008 and run for three years (unless otherwise indicated).

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.

The nomination form and instructions are available at www.geosociety.org. Click on the **Nominate Online for 2008–2009** button to access a secure form. Or download and complete the paper nomination form, and return it to Pamela Fistell, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA, fax +1-303-357-1070. If you have questions, please contact Pamela Fistell, +1-303-357-1000 ext. 0, 1-800-472-1988 ext. 0, or pfistell@geosociety.org.

Nominations received at GSA headquarters by **15 July 2007** on the official one-page form will be forwarded to the Committee on Nominations. Please use one form per candidate. The committee will present at least two nominations for each open position to GSA Council at its fall meeting. Appointees will then be contacted and asked to serve, thus completing the process of bringing new expertise into Society affairs.

Academic and Applied Geoscience Relations Committee (AM, T/E)
Three member-at-large vacancies

Arthur L. Day Medal (T/E)
Two member-at-large vacancies

Geology and Public Policy (AM, B/E, T/E)
Two member-at-large vacancies

GSA Public Service Award (T/E)
One member-at-large vacancy

Honorary Fellows (T/E)
Two member-at-large vacancies

Membership (B/E)
Three vacancies: One member-at-large; one member-at-large, government-employment category; one member-at-large, student category

Minorities and Women in the Geosciences (AM)
Three member-at-large vacancies

Nominations (B/E, T/E)
One member-at-large vacancy

Penrose Conferences and Field Forums (T/E)
One member-at-large vacancy

Penrose Medal (T/E)
Two member-at-large vacancies

Professional Development (T/E)
Two member-at-large vacancies

Research Grants* (B/E)
Seven member-at-large vacancies

***Treatise on Invertebrate Paleontology* Advisory Committee (AM)**
One member-at-large (paleontologist) vacancy

Young Scientist Award (Donath Medal) (T/E)
Two vacancies: One member-at-large; one councilor/former councilor

GSA REPRESENTATIVES TO OTHER ORGANIZATIONS

GSA–AAAS Consortium of Affiliates for International Programs (CAIP) (AM, B/E)
One GSA Representative vacancy

AAPG Publication Pipeline Committee (B/E)
One GSA Conferee vacancy

North American Commission on Stratigraphic Nomenclature (NACSN) (AM, possibly B/E)
One GSA Representative vacancy (Nov. 2008–Nov. 2011)

THE GEOLOGICAL SOCIETY OF AMERICA®

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 Geological Society of America.

July 2008 Committee Vacancies: *Extensive time commitment required AM—Meets at Annual Meeting B/E—Meets in Boulder or elsewhere T/E—Communicates by phone or electronically

THE GEOLOGICAL SOCIETY OF AMERICA®

SCIENCE ▪ STEWARDSHIP ▪ SERVICE

The following individuals were elected into membership by GSA Council at its April 2007 meeting.

Professional Members

Jennifer N. Adleman
R. Jay Akes
Ramanathan Alagappan
Laura Albert
William H. Albright
Eldon P. Allen
Nathaniel H. Allen
Trevor Allen
Manuel Alonso
Randall Alpizar
Efem Altinok
Miriam S. Andres
Clarence H. Andrews
Constantin Andronache
C.D. Anglin
Kristopher E. Appel
Audrey Aronowsky
Far W. Arrington
Marie-Pierre J. Aubry
Nick Bader
Summer J. Barbina
Mark Emmerson Barley
Harry P. Barnum
Fernando Barra
Beth A. Bartel
Debnath Basu
Charles Mario Bauer
Timothy D. Bechtel
Edward Beck
Jean H. Bedard
Thomas H. Beisel
Lahmira Belkacem
Bonnie Bergen
Brian Berkowitz
Elizabeth K. Berner
Bismarck Aurora Bianco
Walter Bien
Alice (Jill) Angelyn Black
Pamela B. Blanchard
Jennifer G. Blank
Alec Bodzin
Paul Bonifaci
Yvette Bordeaux
Ann M. Borden
Alain C.M. Bourg
James R. Bowes
Karin Boyd
Mark Elliott Brandriss
Kevin Brewer
James Breza
Brooks B. Britt
Amanda S. Brooks
Eric Jackson Brosius
Dana R. Brown
Tim O. Brown
Vicki J. Brumback
Pierre W. Bruno
Marcus John Buck
James Carl Bull
Marilyn Kay Bull
Mark D. Bunnell
Mindy Burke
Greta Burles
Delroy Burnett
David R. Burris
Richard M. Busch
Lisa D. Bush
Toni Marie Callaway
Monica A. Calvert
John P. Campbell Jr.
Robert D. Campbell
Steven Carle
Glen B. Carleton
Mike Carr
James Carter
Winston Carter
John Francis Casey
Stephen P. Castleman
Strat Cavros
Stan Celestian
Cory Chance
Mark A. Chapman
Brian D. Chatterton
Dennis W. Cheek
John T. Cheney
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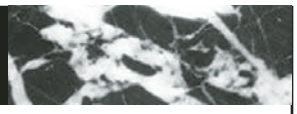
GSA MEMORIALS: Keep The Memories Alive!



GSA publishes a memorial volume devoted to deceased GSA members each year. These memorials are written by associates, friends, or relatives of those who have passed away. Each memorial is valuable and essential to us all for learning more about the fascinating individuals who have been part of GSA.

If you would like to honor a friend or colleague with a memorial, please send it as a Microsoft Word–compatible file via e-mail to awards@geosociety.org. The text should be limited to ~2,000 words and include a selected bibliography of the decedent's works in the earth sciences. Published memorials also include a photo, so please send a picture of the person you are memorializing, either as a high-resolution .jpg attached (as a separate file) to your e-mail or a glossy photograph via post. Complete guidelines for compiling your memorial are at www.geosociety.org/grants/index.htm. Memorialists and family members of the deceased receive complimentary copies of the typeset memorial before it is included in the bound, published volume.

The following is a list of GSA members who passed away between January 2004 and April 2007 for whom no memorial has been received. Bold names signify those who passed away in 2006–2007; asterisks indicate a memorial is in progress.

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THE GEOLOGICAL SOCIETY OF AMERICA®

GSA MENTORING PROGRAMS: A Win-Win Opportunity

The Geological Society of America® runs two mentoring programs at each of its Section Meetings, the **Roy J. Shlemon Mentor Program in Applied Geology** and the **John Mann Mentors in Applied Hydrogeology Program.** These popular events, supported by the GSA Foundation through gifts from Roy J. Shlemon and John Mann, are designed to extend the mentoring reach of individual professionals from applied geology.

The programs provide a forum for undergraduate and graduate students interested in applied geology or hydrogeology as a career to participate in informal conversation with professionals currently practicing in these fields. These programs are relaxed, small-scale, focused events that include a free meal for all participants.

The 2007 season was exceptional. The mentor volunteers—from private and public businesses and government agencies—represented a broad range of backgrounds, education, experience, and expertise. This year, the Shlemon Program funds provided mentor experiences to 444 students through 76 mentors; the Mann Program funds to 168 students through 32 mentors. For both programs, connections were made that resulted in part-time or full-time positions for a number of students.

The GSA Mentoring Program gratefully acknowledges these mentors for their individual gifts of time and for sharing their insight with GSA's student members.

MENTORS HAVE COMMENTED:

"Thanks for the invitation to participate in this luncheon. I really enjoyed meeting the students … it was a win-win situation in my book!"

"I have enjoyed volunteering as a mentor and realize the significance of sharing information with students."

"The students' questions were thought-provoking, and they made me realize what a satisfying job I've got. I'd like to do this again!"

STUDENTS HAVE COMMENTED:

"It was great to meet professionals and to hear from them what they are looking for in employee candidates."

"This program is a great idea. It is not often that we get the opportunity to speak with professionals in our field."

"This program was very enlightening."

To get more information about these programs, or to be a mentor for a future program, contact Jennifer Nocerino jnocerino@geosociety.org.

The Roy J. Shlemon Mentor Program in Applied Geology

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GROUNDWORK
Furthering the Influence of Earth Science

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THE UNIVERSITY OF TOLEDO

The Department of Environmental Sciences at The University of Toledo invites applications for a tenure track position at the **Assistant Professor** level in **Earth Surface Processes** to complement existing university and departmental strengths in ecology, hydrology, geology, geography and environmental engineering. Competitive candidates must have a Ph.D. in the geosciences or a closely related field; postdoctoral experience is desirable. The successful candidate will be expected to provide instruction at the introductory level for nonmajors as well as for the undergraduate and graduate programs in geology and environmental science.

Our department is a rapidly growing, multidisciplinary, research-oriented academic unit with 23 tenured/tenure-track full-time faculty. The primary research focus envisioned for the candidate is on physical interactions at the land-lake-air interfaces, with application to the Lake Erie Basin. Applicants should have expertise in the application and utilization of remote sensing and computerized geospatial analysis in their research. Research opportunities are particularly promising in the western Lake Erie basin, where the confluence of an intensively used agro-urban watershed and an economically and ecologically critical water body produce an ideal natural laboratory for environmental research. This person will be expected to develop an externally funded research program as well as collaborate with colleagues in ongoing large scale, multidisciplinary research projects including watershed investigations, remediation and wetlands restoration.

It is anticipated that this position will begin in mid-August 2008. Review of applications will begin 5 October 2007 and continue until the position is filled. Salary, fringe benefits and start-up funds are competitive. Applicants should submit curriculum vitae, descriptions of teaching and research interests, and the names and addresses of three references to: Alison Spongberg, Chair, Search Committee, Earth Surface Processes, Department of Environmental Sciences, Mail Stop #604, University of Toledo, Toledo, OH 43606-3390. The University of Toledo is an equal opportunity, equal access, affirmative action employer and educator. M/F/V/D are encouraged to apply. For more information visit the Departmental Web site, www.eeescience.utoledo.edu.

GEOPHYSICS
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The Department of Geology at Southern Illinois University Carbondale invites applications for a tenure-track position in Geophysics at the rank of assistant professor with a start date of 16 Aug. 2008. Preference will be given to candidates with post-doctoral experience. The applicant should demonstrate the existence of, or potential for developing, an internationally recognized, externally funded research program. The candidate's research interest is open, but we prefer a Geophysicist who will complement our existing strengths. The successful applicant is expected to teach courses in introductory geology and undergraduate and graduate courses in their area of expertise. Normal teaching load is one to two courses per semester. Applicants must hold a Ph.D. in geology or a related field or show that they will complete all degree requirements by the time of appointment.

Review of applications will begin 1 October 2007 and continue until the position is filled. Applicants should submit a curriculum vitae, a statement of teaching and research interests, and the names and addresses of at least three referees to: Dr. John Sexton, Search Committee Chair, Department of Geology, Mail Code 4324, Southern Illinois University Carbondale, 1259 Lincoln Drive, Carbondale, IL 62901; fax: +1-618-453-7393; e-mail: sexton@geo.siu.edu.

Southern Illinois University Carbondale is a large, research-oriented institution situated in a pleasant small-town setting southeast of St. Louis. SIUC is seeking to enhance interdisciplinary research as it strives to be a top 75 public research university (http://news.siu.edu/s150/). The Geology Department has a full-time faculty of 10 with about 40 undergraduate and 30 graduate students and offers Bachelor and Master degree programs in geology and participates in the interdisciplinary Environmental Resources and Policy Ph.D. program. SIUC has programs and facilities involved with energy and mineral resources research that provide opportunities for interdisciplinary studies including the Coal Research Center and the Mining and Mineral Resources Program.

For further information, please visit our comprehensive website www.science.siu.edu/geology. SIUC is an affirmative action/equal opportunity employer that strives to enhance its ability to develop a diverse faculty and staff and to increase its potential to serve a diverse student population. All applications are welcomed and encouraged and will receive consideration.

USTAR POSTDOCTORAL FELLOWS
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The University of Utah invites applications for two postdoctoral fellowships jointly appointed between the Energy & Geoscience Institute (EGI) and the Department of Civil and Environmental Engineering. We seek highly qualified individuals with research experience and interest in the science and engineering of CO_2 sequestration related to climate change mitigation. The appointments are jointly funded by the Utah Science, Technology and Research initiative (http://ustar.utah.gov) and the Energy & Geoscience Institute (http://egi.utah.edu). The Utah Science, Technology and Research (USTAR) Economic Development Initiative is a prestigious program initiated by the state of Utah and designed to spur job growth and economic development. These USTAR Postdoctoral Fellows will help design, deploy and lead the science and engineering of six major field projects of underground

geological CO_2 injection and storage, with sites in Utah, Wyoming, Colorado, New Mexico and Texas. Within this aggressive carbon sequestration field program, the minimum size deployment is injection of 75,000 tons/yr, with others approaching 1,000,000 tons/yr.

A Ph.D. at the time of appointment in civil and environmental engineering, hydrology, earth and environmental science, or a closely related field is required, as well as a significant record of research productivity. We seek individuals who complement existing strengths at EGI, the Department of Civil and Environmental Engineering, and who can work collaboratively in the Carbon Engineering group (http://egi.utah.edu/CO2) at the university. We especially seek candidates with experience in numerical modeling, including coupled multiphase simulation modeling and/or reactive transport modeling and/or coupled hydrogeomechanical modeling at multiple spatial scales. We also seek individuals with significant experience in laboratory experimental work related to high pressure, high temperature multiphase flow. Field-experience is a plus. Our research program offers competitive salaries and opportunities for career advancement. To apply, please send a CV, relevant publications and the contact information of three references to Energy & Geoscience Institute Attn: USTAR at 423 Wakara Way #300, Salt Lake City, UT 84108. Applications will be accepted until the positions are filled. No e-mail applications accepted. For detailed inquiries, contact Prof. Brian J. McPherson, b.j.mcpherson@utah.edu.

QUATERNARY GEOLOGIST/SURFICIAL PROCESSES ASSITANT PROFESSOR, WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, (WGNHS) MADISON, WISCONSIN

The Department of Environmental Sciences, UW-Extension is looking for a full-time, tenure-track faculty position available 1 January 2008. Responsibilities include conducting fundamental and applied research in Quaternary geology/surficial processes through field-based investigations, including geologic mapping. Focusing on the Quaternary deposits of Wisconsin, conducting research in glacial geology, sedimentology, geochemistry, geochronology, geomorphology, or engineering geology. Work in cooperation with other WGNHS Staff, University personnel and collaborate with local, state, and federal agencies that have interests in geology, geophysics, hydrogeology, and mineral resources. Applications will be reviewed beginning 8/15/2007. For a complete position description and how to apply, please visit www.uwex.edu/ces/hr.

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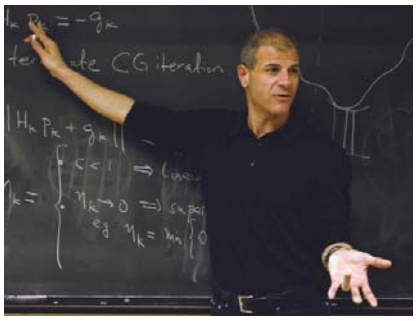

The coupling between devaluation of writing in scientific authorship and inflation of citation indices

Terry Engelder, *Department of Geosciences, The Pennsylvania State University, University Park, Pennsylvania 16827, USA*

Traditionally, scientific authorship was earned by those who contributed to the intellectual enterprise of a paper through writing and rewriting. Like the effect of grade inflation on the value of A-grades awarded at the top research universities, the act of writing as a prerequisite for authorship in the geosciences literature has rapidly evolved over the past three decades. An analysis of authorship of *Geology* papers illustrates this evolution. With its inaugural issues in late 1973, the standard for authorship was set at 1.9 authors per paper with 46% of all *Geology* papers written by single authors the mode that first year (Fig. 1). Less than 10% of these 1973 papers claimed more than three authors. The source of intellectual input into the communication of scientific discovery was clear during the early history of *Geology*.

After 1973, the average number of authors per paper continued to rise steadily. By the mid-1980s, the mode for authorship in *Geology* shifted to two, a number that remains the mode to this day. As much as anything, this mode reflects writing shared between graduate student and mentor. Sometime later, in the 1990s, the average number of authors per paper in *Geology* exceeded three. During the latter half of 2006, the average number of authors per paper broke above four, a level of authorship where the source of intellectual input through writing becomes unclear. In the 2006 sample, only 3% of all *Geology* papers were written by a single author, and the percentage of first authors also dropped to an all-time low.

Aside from a devaluation of writing as a prerequisite for authorship in *Geology* papers, what does all this mean?

The trend in authorship for *Geology* papers seems to correlate with the tilt of earth science toward multidisciplinary collaboration. Indeed, the National Science Foundation developed the capability for principal investigators to submit collaborative proposals in response to the scientific community's desire to submit such proposals (D. Fountain, 2007, personal commun.). Big science does require the integration of outputs from a number of laboratories, and these should be recognized. The trend in authorship also correlates with the proliferation of cross-border projects, particularly those focused on the Himalayans, the Andes, and other areas. Multi-government funding of large programs in the oceans and in space also contributed to this

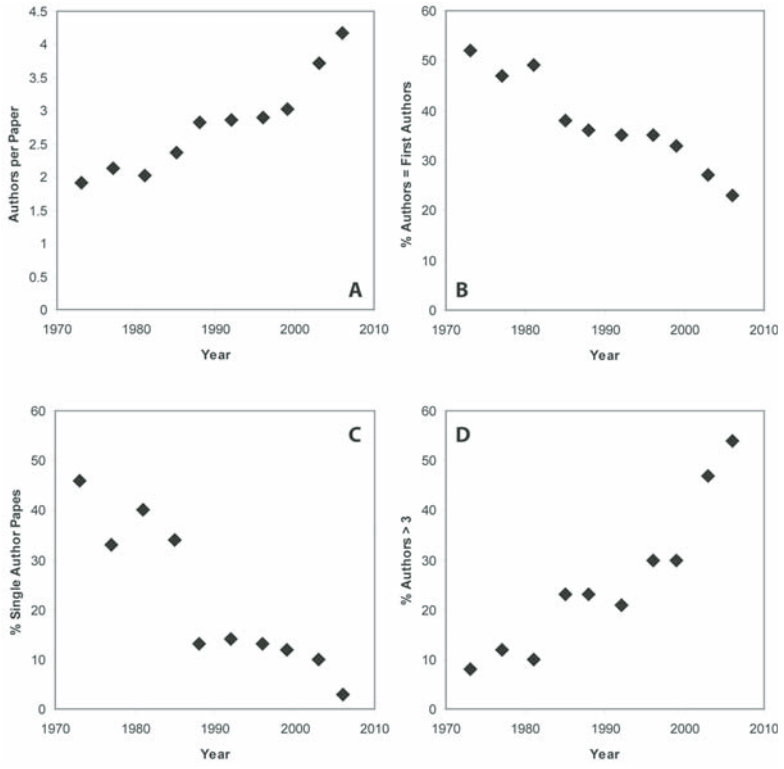

Figure 1. Data on authorship in samples of papers published in *Geology* since its inception in 1973. With the exception of the 1973 sample, all other samples are from six-month or twelve-month periods depending on which sample yielded between 100 and 150 papers, thereby normalizing the number of papers from year to year. The six-month samples were arbitrarily selected within the publication year. Large-project papers were binned according to the number of authors listed in the contents of each issue. (A) Average number of authors per *Geology* paper from a sample of between 100 and 150 papers. (B) Percentage of first authors in the total author pool. (C) Percentage of single-author papers. (D) Percentage of authors who were not listed as one of the first three authors in the total author pool.

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trend. By scientific etiquette, the results of each of these types of projects require broad recognition. The question is whether this recognition should come through citations or through the addition of names to the authorship lists that in *Geology* have reached as high as 14 as of late.

The trend in authorship in *Geology* reflects the vitality of the earth sciences as political borders and project size are no longer the obstacles they once were. It is equally vital for the science to take advantage of many data sets, some of which require very expensive machines to gather. However, there is an issue about whether the intellect of the individual is being squeezed out by "big" science as we move into the twenty-first century. One interpretation of the authorship data from papers published in *Geology* is that there is far less individual initiative, at least in terms of writing, than there was 30 years or more ago. This trend (i.e., the devaluation of writing as a prerequisite for authorship) is of concern, in part because the trend signals the diminution of the solitary thinker and writer. After all, writing is a major component of intellectual enterprise leading to good science, and writing is less effective when the committee of writers and rewriters grows beyond a very low number.

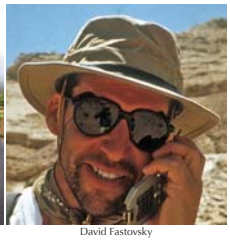
A corollary to the devaluation of writing in scientific discovery is the inflation of citation indices. Under the present system, for a 14-author *Geology* paper cited once, each author will claim that citation in his or her personal citation index. That paper increments 14 citation indices once and thus has the same effect as 14 citations of a single-author *Geology* paper where the single author has his index incremented 14 times. The hardest part of scientific discovery is the communication aspect, yet in a 14-author *Geology* paper, communication, usually the first author's responsibility, is given no greater reward that that received by the fourteenth author. It seems that the next best mechanism for padding citation indices beyond self-citation is to join a number of multi-author papers.

To correct the dual predicament of devaluation of writing in scientific authorship and inflation of citation indices, I draw a distinction between the present *citation index*, where each author claims a citation independently of the number of authors and *citation credit* (value of a particular paper normalized by the number of authors) plus *citation credit index* (citation credit multiplied by the number of citations). To the best of my knowledge, the terms citation credit and citation credit index are new to the literature. I suggest that each paper be awarded a maximum of two citation credits per paper with the first author always earning one credit per citation. A second credit would be divided evenly among the secondary authors. Thus, in the typical 14-author *Geology* paper, each of the secondary authors earns a 0.08 credit per citation for the paper, and this would be the number claimed by secondary authors on their annual promotion and tenure or salary review dossiers and other documents of self-congratulation. In a two-author *Geology* paper, each author would earn one credit per citation, thereby allowing a thesis advisor to earn his or her just due for preparing a thesis for publication when the graduate student disappears into some job that does not reward publication. With this citation credit algorithm, communication of scientific discovery would be restored to its proper position in the reward hierarchy of the geoscience community.

GSA TODAY

Science Editor Changes


Gerry Ross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Stephen T. Johnston

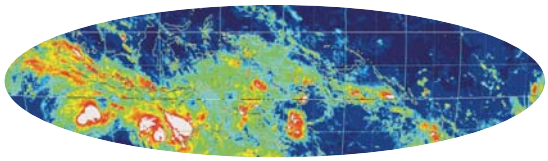
Gerry Ross has completed his term and then some as *GSA Today* science co-editor. Ross will keep his hat in the geoscience arena by following an earth systems approach to the application of the principles of soil science, aqueous geochemistry, and geomicrobiology to organic agriculture on his farm in Maui. GSA Pubs will miss working with you, Gerry!

David Fastovsky, a GSA Fellow familiar to many, steps in as *GSA Today*'s new science co-editor. Fastovsky received the GSA Distinguished Service Award last year after several years as *Geology* editor (1999–2005), service on numerous GSA committees, and work as associate editor on *GSA Bulletin* (1996–2000).

Science co-editor **Stephen T. Johnston**, who began his term last year, continues his quest "to bring forward high-quality articles that appeal to as broad an audience as possible and that spark debate within our community regarding the major societal and scientific questions facing the earth sciences."

GSA Today science editors are charged with obtaining first-class, focused articles that collectively reflect and summarize current topics and discoveries in the earth sciences. Science editors also solicit "Groundwork" articles, *GSA Today*'s newest article series, meant to further the influence of earth science on education, policy, planning, and funding. All submissions, whether solicited or volunteered, are reviewed. To submit a science or Groundwork article to *GSA Today*, send your manuscript and figures via e-mail directly to Stephen Johnston, stj@uvic.ca, and David Fastovsky, defastov@uri.edu.

Editor's Note: *The following guideline applies to all* Geology *submissions: "For multi-author papers,* Geology *editors expect that all the authors have been involved with the work, have approved the manuscript, and agree to its submission. A statement on the respective roles of each author when more than five authors are listed is required."* ■



MULTIPLE HIRES IN CLIMATE SYSTEMS SCIENCE

The Jackson School is building a premier education and research program in Climate System Science. We seek scientists at the forefront of their disciplines attracted to challenging areas of scholarship that require collaboration across disciplines and programs. We seek the expertise required to address fundamental questions associated with a changing Earth system, including:

- What processes control the rates of change and variability of the climate system, including the atmosphere, ocean, cryosphere, land surface, and biosphere?
- Can we improve our ability to anticipate these changes and determine the potential impacts on society?

Over the next three years, we will hire six or more faculty and scientists who complement our growing strengths. We will hire individuals who will enable us to build a comprehensive climate program and who will make fundamental advances in our understanding of the climate system. These areas include, but are not limited to:

- Improved modeling of the Earth system, specifically including ice sheets, the global carbon cycle, and interaction between the components of the Earth system.
- Enhanced observation of the Earth system, including remote sensing of Earth-surface processes and components.
- Greater capability to utilize geologic archives to understand climate change, including paleoclimatology, paleoceanography, and paleobiology.
- Improved ability to link climate and hydrology, particularly at the basin-to-continent scale.
- Increased strengths in atmospheric dynamics and physical oceanography.
- Increased ability to understand variability and quantify uncertainties, including statistical climatology.
- Greater capability to address societal impacts and vulnerability, including adaptation and mitigation.

We encourage applications from innovative scientists in other areas that are related to climate system science.

MULTIPLE HIRES IN ENERGY—SCIENCE, ENVIRONMENT, AND POLICY RESEARCH

The Jackson School is building a premier education and research program in Energy—Science, Environment and Policy Research. We seek scientists at the forefront of their disciplines attracted to challenging areas of scholarship that require collaboration across disciplines and programs. We seek to address compelling questions within the broad theme of determining how we can create an energy future that is sustainable and environmentally and economically robust. These questions include, but are not limited to:

- How can we integrate classically separated disciplines (geomechanics, geochemistry, tectonics, stratigraphy, petrophysics, geophysical imaging, regional/basin scale studies) to advance interrelationships at the forefront of energy and environmental science?
- How do fluid-rock interactions and the interplay between mechanical and chemical processes influence fluid flow and storage in the subsurface?
- How can we improve identification and recovery of energy resources by comprehensive integration of information at all scales, integrated numerical modeling, and innovative automated and continuous monitoring?
- Can we solve the compelling environmental issues associated with the extraction and use of fossil fuel energy sources, including water and land use, and carbon sequestration?
- Can we develop energy policies founded on solid scientific and engineering information and innovative approaches that will simultaneously promote environmental stewardship and energy security?

Over the next three years we will hire six or more faculty and scientists who complement our existing strengths. We are interested in a wide variety of research areas ranging from rock/fluid systems, subsurface sensing, tectono-stratigraphy, carbon management, energy economics and policy, basin-scale analysis and modeling, and resource and reserve geoinformatics. We also encourage applications from innovative scientists in other areas related to energy—science, environment and policy.

Opportunities exist at any level, can include cluster hires, and can be within or in combination with any Jackson School Unit—the Department of Geological Sciences, the Bureau of Economic Geology, or the Institute for Geophysics. The schedule of appointment is also negotiable. For more information on the school and its hiring program visit us online at www.jsg.utexas.edu/hiring.

Ph.D. is minimum requirement for application. Send inquiries and applications (cover letter, CV, list of publications, list of references, statements of teaching and/or research interests) to: Randal Okumura, Office of the Dean / Jackson School of Geosciences, The University of Texas at Austin / PO Box B, University Station / Austin, TX 78713 or jobs@jsg.utexas.edu.

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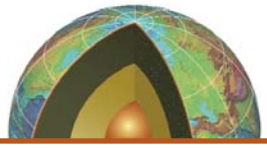

MULTIPLE HIRES IN CRUST, MANTLE, AND CORE DYNAMICS

The Jackson School is building a premier education and research program in Crust, Mantle, and Core Dynamics. We seek scientists at the forefront of their disciplines attracted to challenging areas of scholarship that require collaboration across disciplines and programs. We particularly seek individuals eager to address the questions encompassing the broad theme of determining how the core, mantle, crust, and surface interact to shape the physical, chemical, and biological evolution of the Earth across a wide range of spatial and temporal scales. These questions include, but are not limited to:

- What controls the style, vigor and time dependence of mantle and core convection?
- How are chemical and physical processes acting in the Earth's interior manifested at the surface and how do surface processes affect Earth's interior?
- What controlling influence do fluids have on geological processes in the Earth's crust and mantle?
- How can knowledge of active tectonic processes and present-day plate motions be utilized to better decipher Earth's history?

Over the next three years, we will hire six or more faculty and scientists who complement our existing strengths. We are interested in a wide variety of research areas ranging from geodynamics, seismology, mineral physics, GPS/remote sensing of active and surface deformation, fluid dynamics, geochronology, geochemistry, rock physics, and computational geosciences focusing on modeling and simulation. We also encourage innovative scientists in other areas related to crust/mantle/core dynamics to apply. Successful applicants will join a strong and diverse group of 125 Ph.D. faculty and scientists, with the facilities and partnerships that will help ensure their success.

MULTIPLE HIRES IN EARTH SURFACE AND HYDROLOGIC PROCESSES

The Jackson School is building a premier education and research program in Earth Surface and Hydrologic Processes. We seek outstanding scientists at the forefront of their disciplines who are attracted to challenging areas of scholarship that require collaboration across disciplines and programs. We seek to address compelling questions in surface and hydrologic processes within the broad theme of determining how surface and hydrologic processes are influenced by their dynamic setting at the interface of the lithosphere, atmosphere, hydrosphere, and biosphere. These questions include:

- How do climate, ice sheets, and tectonics interact to define the distribution and character of sea level change?
- How do coastal zone geology, biology, biogeochemistry, and hydrology respond to surficial processes, particularly to sea level change?
- What are the impacts of climate variability/change and land use change on water, nutrient, and sediment cycles?
- What is the integrated result of the interplay between tectonic deformation, climate change, and biota on the Earth's surface and on the supply, distribution, and storage of sediments?
- What are the physical, chemical, ecological processes and social forces that will determine the sustainability of our water resources?

Over the next three years, we will hire six or more faculty and scientists who complement our existing strengths. We are interested in a range of research areas from quantitative geomorphology to hydrologic-biologic interactions to societal impacts and resource sustainability, and capabilities ranging from modeling landscape dynamics to remote sensing, shallow environmental geophysics, aerogeophysics, and monitoring groundwater and coastal systems. We also encourage innovative scientists in other areas related to surface and hydrologic processes to apply.

Opportunities exist at any level, can include cluster hires, and can be within or in combination with any Jackson School Unit—the Department of Geological Sciences, the Bureau of Economic Geology, or the Institute for Geophysics. The schedule of appointment is also negotiable. For more information on the school and its hiring program visit us online at www.jsg.utexas.edu/hiring.

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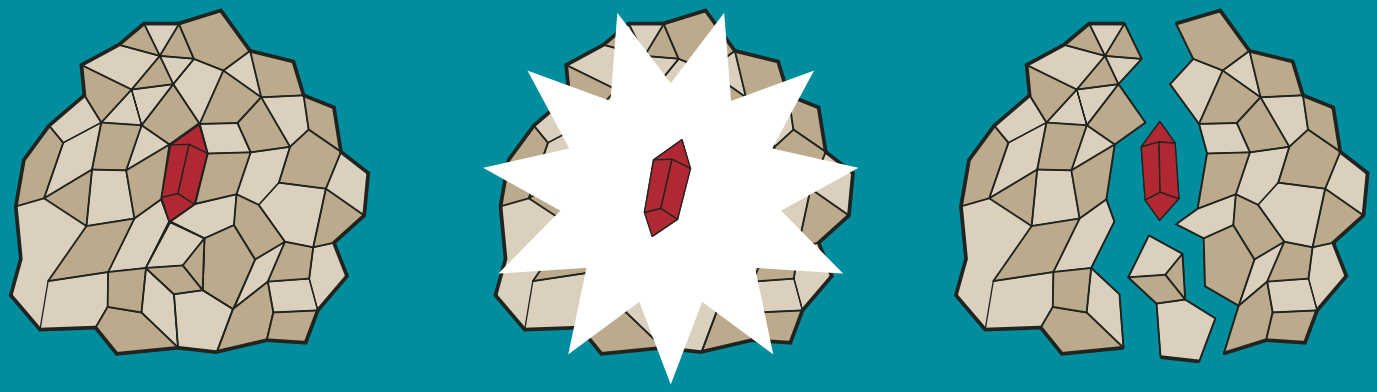
Worldwide launching of selFrag Lab



The first commercial high voltage pulsed power laboratory equipment for selective fragmentation

For the first time, selFrag-Lab makes selective fragmentation by means of the elctrodynamic high voltage (HV) pulsed power process commercially available. Under a worldwide license from the Research Center of Karlsruhe in Germany, selFrag AG (Div. of Ammann-Group) has developed and commercialized the technology. This state-of-the-art electrodynamic process is far more efficient in comparison to the any electrohydraulic approach. Controlled variable HV-discharges of very short duration are applied to solids under water. Very fine plasma channels and the resulting shock waves propagating through the solids cause the material to disaggregate along grain boundaries, inclusions or inhomogeneities. The fragmentation process of selFrag-Lab is highly selective in contrast to mechanical crushing and milling. It liberates morphologically intact minerals while minimizing the production of undesired fines.

The laboratory fragmentator selFrag-Lab is a user friendly and compact piece of equipment designed for use in a wide range of laboratory environments, in the mining and oil & gas industries, as well as in geologic surveys or other research institutes. Here selFrag-Lab offers new possibilities in the exploration of natural resources, in paleontology and planetology, in material analysis, or process development. More detailed information is available at www.selfrag.com.

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