GSA TODAY

VOL. 14, NO. 9 A PUBLICATION OF THE GEOLOGICAL SOCIETY OF AMERICA SEPTEMBER 2004

Wrightwood and the Earthquake Cycle: What a Long Recurrence Record Tells Us About How Faults Work

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

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VOLUME 14, NUMBER 9

SEPTEMBER 2004

Cover: The Wrightwood paleoseismic site lies 4 km northwest of the town of Wrightwood, California, in the San Gabriel Mountains ~70 km northeast of Los Angeles. The site is at ~6000 ft and the view is to the southwest across a series of northwest-trending ridges and valleys that follow the San Andreas fault zone. Photo by M. Rymer, U.S. Geological Survey. See "Wrightwood and the earthquake cycle: What a long recurrence record tells us about how faults work," by Weldon et al., p. 4–11.

SCIENCE ARTICLE

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Wrightwood and the earthquake cycle: What a long recurrence record tells us about how faults work

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ABSTRACT

The concept of the earthquake cycle is so well established that one often hears statements in the popular media like, "the Big One is overdue" and "the longer it waits, the bigger it will be." Surprisingly, data to critically test the variability in recurrence intervals, rupture displacements, and relationships between the two are almost nonexistent. To generate a long series of earthquake intervals and offsets, we have conducted paleoseismic investigations across the San Andreas fault near the town of Wrightwood, California, excavating 45 trenches over 18 years, and can now provide some answers to basic questions about recurrence behavior of large earthquakes.

To date, we have characterized at least 30 prehistoric earthquakes in a 6000-yr-long record, complete for the past 1500 yr and for the interval 3000–1500 B.C. For the past 1500 yr, the mean recurrence interval is 105 yr (31–165 yr for individual intervals) and the mean slip is 3.2 m (0.7–7 m per event). The series is slightly more ordered than random and has a notable cluster of events, during which strain was released at 3 times the long-term average rate. Slip associated with an earthquake is not well predicted by the interval preceding it, and only the largest two earthquakes appear to affect the time interval to the next earthquake. Generally, short intervals tend to coincide with large displacements and long intervals with small displacements. The most significant correlation we find is that earthquakes are more frequent following periods of net strain accumulation spanning multiple seismic cycles.

The extent of paleoearthquake ruptures may be inferred by correlating event ages between different sites along the San Andreas fault. Wrightwood and other nearby sites experience rupture that could be attributed to overlap of relatively independent segments that each behave in a more regular manner. However, the data are equally consistent with a model in which the irregular behavior seen at Wrightwood typifies the entire southern San Andreas fault; more long event series will be required to definitively outline prehistoric rupture extents.

INTRODUCTION

It is widely believed that recurrence of great earthquakes on large faults like the San Andreas is regular to some degree. While this hypothesis has notable critics (e.g., Davis et al., 1989; Kagan and Jackson, 1999), its credence is rooted in acceptance of the elastic rebound theory, the constant drive of plate tectonics, and their implications for the earthquake cycle. As first published (Reid, 1910) and as applied today (e.g., Working Group on California Earthquake Probabilities, 2003), the theory implies that tectonic strain accumulates gradually between earthquakes and is suddenly released during earthquakes. Implicitly or explicitly (see Matthews et al. [2002] for an excellent summary of the application of the elastic rebound theory to earthquake forecasting), earthquake rupture on a fault is assumed to occur at a strain threshold and the earthquake decreases the strain to some base level, essentially "resetting the clock" for the next cycle.

If the earthquake strain cycle contains either upper or lower strain thresholds, one would expect to see relationships between earthquake time intervals and displacements, often called time- and slip-predictable earthquake behavior (Shimazaki and Nakata, 1980). A time-predictable model has an upper strain threshold, so the time to the next earthquake can be "predicted" by the displacement of the last earthquake; the more strain released in an earthquake, the longer it will take to build up the required strain for the next one. Slip-predictable models have a lower threshold, so the length of the interseismic period "predicts" the amount of slip in the next earthquake. If both upper and lower thresholds in strain exist, the system is "characteristic" and the fault cycles between two fixed strain levels (e.g., Ellsworth, 1995); variations in interval length are due only to variations in strain accumulation or the "load path" (Matthews et al., 2002).

Resetting of the clock during each earthquake not only is conceptually important but also forms the practical basis for all earthquake forecasting because earthquake recurrence

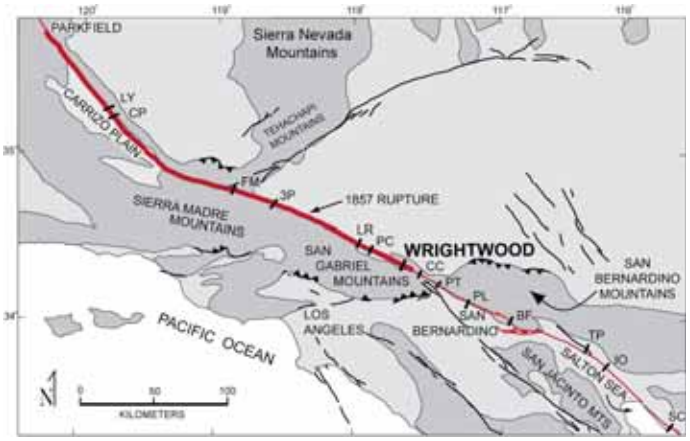

Figure 1. The San Andreas fault (red) passes less than 100 km northeast of Los Angeles and bounds the urban region near San Bernardino. The last rupture (1857, bold red line) included 300 km of the 530 km of fault southeast of Parkfield. Black bars across the fault are sites with paleoseismic or slip rate data (abbreviations and references in Fig. 12).

GSA Today; v. 14; no. 9, doi: 10.1130/1052-5173(2004)014<4:WATECW>2.0.CO;2

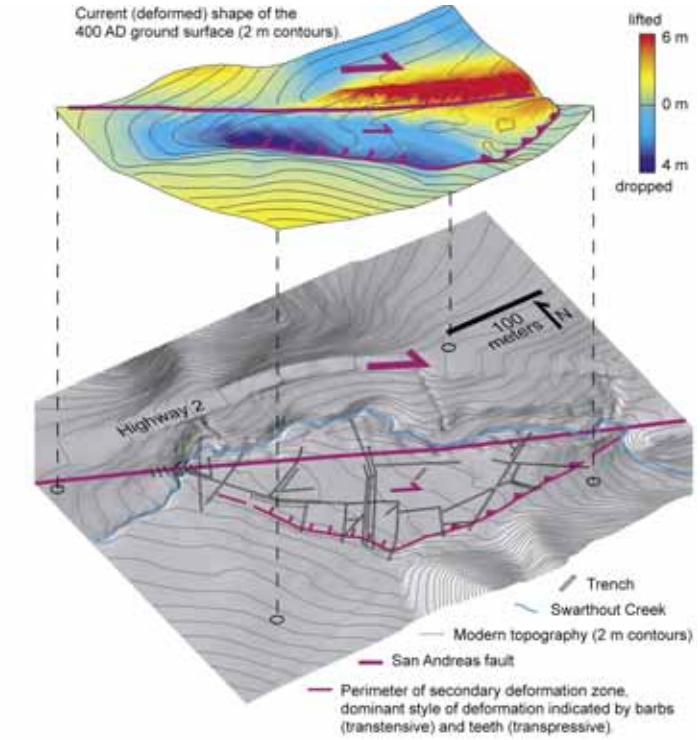

Figure 2. The Wrightwood paleoseismic site is a flake or half-flower structure that was incised and drained by Swarthout Creek in the late nineteenth century. The colored map portrays the ground surface at the time of a key marker bed at the base of our "Upper Section." Contours show the reconstructed shape of this surface and colors indicate how much the surface has been deformed since 400 A.D. A combination of north-side-up slip across the northern trace, transtension across the southwest portion of the southern trace, and transpression across the southeast portion of the southern trace creates a closed depression that was continuously and rapidly filled with peat and debris flows from Government Canyon (a steep canyon southwest of the mapped area).

is statistically modeled as a renewal process (Cornell and Winterstein, 1988). In a renewal process, intervals between earthquakes must be unrelated so their variability can be expressed by (and conditional probabilities calculated from) independent random variables. Thus, if the next earthquake depends upon the strain history prior to that earthquake cycle, both our understanding of Earth and our forecasts of earthquake hazard must be modified.

A critical limitation to testing this important hypothesis is the length of earthquake records from individual faults (Ogata, 1999; Biasi et al., 2002). Attempts to circumvent this limit by combining many short records (e.g., Nishenko and Buland, 1987; McCalpin and Slemmons, 1998) have been unsuccessful (Goes, 1996; Matthews et al., 2002). An equally significant limitation, not as often explored in the literature, is the paucity of data on the variability of earthquake displacements on individual faults. With the exception of seismological data from a few potentially unusual settings (Ellsworth, 1995; Nadeau and Johnson, 1998), the lack of displacement data precludes direct comparison of recurrence interval and slip for individual earthquake cycles. The southern San Andreas (Fig. 1) has been a region of pioneering paleoseismic research (Sieh, 1978; Sieh et al., 1989) but until now has not had long records of displacements and enough sites with long records to seriously consider the extent of paleoearthquakes.

THE WRIGHTWOOD SITE

The Wrightwood paleoseismic site is a structural depression created by the San Andreas fault that is intermittently inundated by debris flows deposited into the linear valley that follows the fault (Fig. 2; see Weldon et al. [2002] for a detailed description of the site, structure, and stratigraphy). The northern edge of the depression has been fixed for at least 6000 yr, but the southern margin has migrated outward, enlarging the depression through time. While we have been able to unravel the timing of nine earthquakes on the narrow northern trace (Fumal et al., 1993; 2002b), the outward migration of the structure to the south separates evidence for earthquakes in space, allowing us to characterize dozens of paleoearthquakes. While some of the structures south of the straight and narrow northern trace have documented right-lateral slip, in many cases we can only recognize the normal or reverse components of deformation, and the linkages and kinematics of structures must be inferred. It is possible that some of the deformation in the previously water-saturated bog is shaking related rather than primarily fault driven. However, for the time intervals for which we have deposits preserved across the entire site, the southern traces have always slipped simultaneously with the

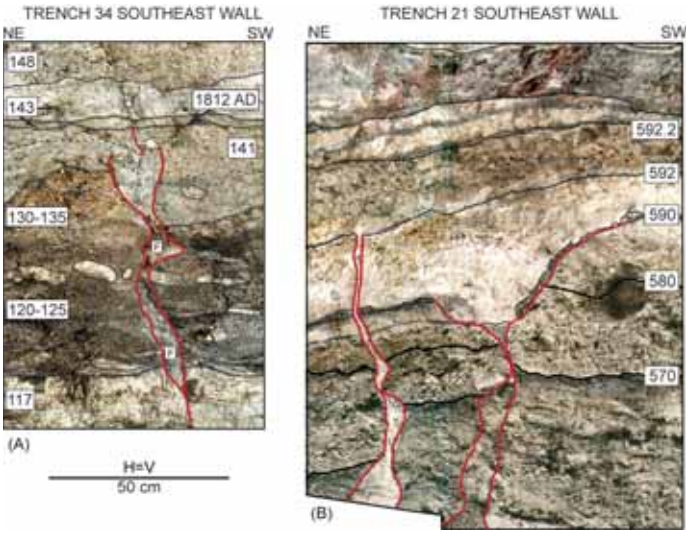

Figure 3. Photos of earthquake evidence from (A) Upper and (B) Deep Section at Wrightwood. Red lines indicate faults and fissures, black lines mark stratigraphic contacts. (A) Centered at meter 25.7, a fissure formed during the historic 1812 A.D. rupture. At this location, debris flow 141 was in place before the event, subsequently capped by unit 143. (B) Exposure of two closely timed paleoearthquakes. The older event created the U-shaped fissure in the center of the photo during growth of peat 590, which continued to grow after the earthquake on the southwest side of the fissure. The younger event is represented by a liquefaction feature, a pipe (left) that broke through layers 592 and older.

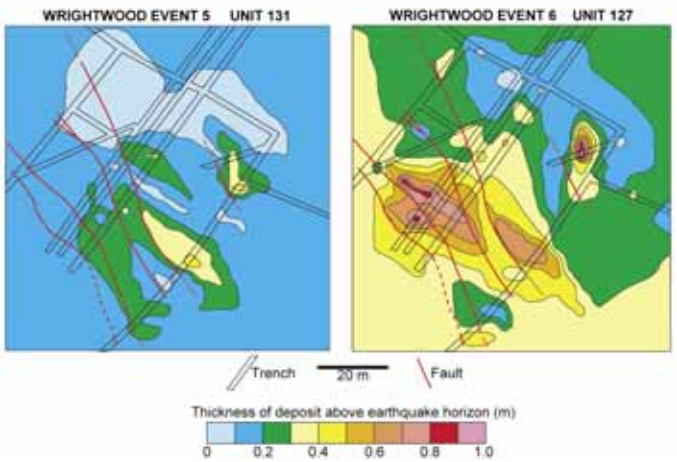

Figure 4. Isopach maps of debris flow layers map out the vertical component of deformation associated with individual paleoearthquakes (from Fumal et al., 2002b). Coseismic folding and faulting results in thickness variations in the sedimentary units that bury the deformed ground surface. Lateral displacements may also be reconstructed from the subsequent offset of these thickness variations and calculations relating the vertical displacement to lateral slip across the known three-dimensional geometry of the faults (see Weldon et al. [2002] for details).

narrow northern trace. This suggests that any gravity-driven deformation occurred during earthquakes (see Weldon et al. [2002] for a detailed discussion of this issue).

The stratigraphic section is at least 30 m thick and consists of alternating debris flow deposits and organic peat-like layers laid out in such a way that the entire record is within trenching depth somewhere on the site (Fig. 2). We have dated ~50 of the several hundred peat layers, focusing on the past ~1500 yr (the "Upper Section") and 3000–1500 B.C. (the "Deep Section"), intervals which we have explored sufficiently to infer a record of earthquakes. Debris flow layers comprise ~70% of the stratigraphy but the organic bog deposits probably represent nearly 100% of the time, which is determined by C-14 dating. Historic debris flows in the region usually occurred during quick snow thaw events and do not temporally correlate with earthquakes (Sharp and Nobles, 1953; Morton and Campbell, 1974). Clast sizes are primarily medium-grained gravel to fine sand and silt; subangular cobbles and boulders up to a meter across occur in the southwest part of the site (Fig. 2). All clastic units are matrix supported, moderately to poorly sorted, and many are reversely graded. In many cases, the layers are continuous across the site (physically traced in trenches for 100s of meters), have centimeter-scale variation in thickness in undeformed regions, and generally thin slightly toward the northern and southeastern boundaries of the site. In over 2 km of excavations of debris flows in cross section, we observe only one depositional feature that might be a transverse ridge and no features that resemble lateral or terminal margins, strongly suggesting that these debris flows extended well beyond the site.

As earthquake ruptures passed through the site, the layers below the wet surface were offset and folded and the surface ruptured, fissured, and warped (Fig. 3). Following the earthquake, sedges and other wetland plants resumed growing, and eventually a debris flow buried the deformed bog surface, often filling still-open fissures (sometimes we even see a thin coating of peat that grew on a fissure wall before the debris flow filled it). It is possible that another earthquake could occur before the evidence from the previous is buried, perhaps causing us to miss an event. However, the rapid sedimentation (on average ~0.7 m of sediments separate each earthquake in the Upper Section), continuous peat growth, and the fact that earthquakes often offset faults and folds formed during previous earthquakes makes it unlikely that we have missed many earthquakes. The only known exception is ~1300–1400 A.D. when there was no clastic sedimentation and the swamp briefly dried up and developed a soil. During this time an event is recognized at San Andreas fault sites to the northwest and southeast, so we infer that an event probably occurred at Wrightwood without a decipherable record (Table 1).

We also have confidence in our event recognition because we see evidence for each earthquake in multiple trenches, and each event has its own signature or style of deformation. This can be seen in Figure 4 (from Fumal et al., 2002b) where event 5 had minor deformation, whereas the previous event (6) had substantial faulting and folding. In some cases deformation overlaps, but in other areas we see evidence for only one of the events. The timing evidence for individual earthquakes is summarized in Figure 5 (for the Upper Section, we have placed the numerical values for the ages and offsets that we will use in our analysis in Table 1).

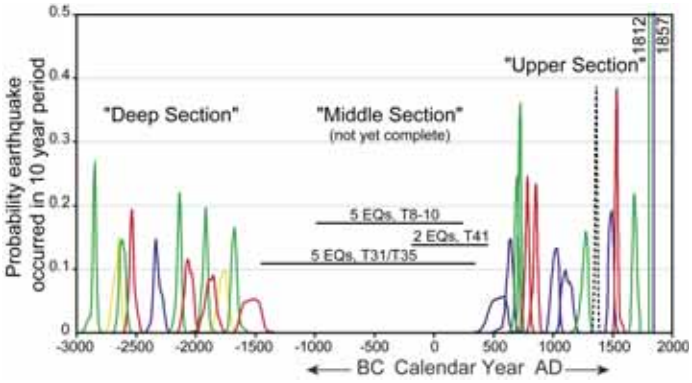

Figure 5. Our current understanding of the ages of ground rupturing earthquakes at Wrightwood. Peaks represent probability distribution functions (pdfs) for the ages of the earthquakes (historic 1812 and 1857 would extend to 1.0 on the vertical scale). Colors represent the relative abundance and quality of the data; green is average, red is exceptional, blue is below average, and yellow is poor or may not be events. The black dashed pdf is an event seen northwest and southeast of our site that falls in a depositional hiatus at Wrightwood. The "Upper Section" is complete and each earthquake's offset is estimated; the "Deep Section" is believed to be complete but does not yet have displacement estimates. The "Middle Section" is certainly incomplete because we have not yet exposed enough of this portion of the sedimentary and structural record. For the complete sequences, Poisson behavior can be dismissed at ~70% confidence level (Biasi et al., 2002).

TESTS OF EARTHQUAKE BEHAVIOR

To investigate the relationship between recurrence interval and displacement we have plotted the data from Table 1 to evaluate slip or time predictability (Figs. 6 and 7). The series is certainly not slip predictable. Any possibility of time predictability resides in the long intervals following the two largest displacements; except for them, one could argue for a negative correlation similar to that seen for the slip predictable test.

The possibility that the two exceptional displacements had a different effect than the moderate or small displacements may be significant because it has been argued that an exceptionally large 1906 rupture depressed activity on the northern San Andreas fault system for most of the twentieth century (Working Group on California Earthquake Probabilities, 2003). It has also been proposed (e.g., Sieh et al., 1989) that rupture of the entire 530 km of the southern San Andreas fault occurs occasionally. If exceptionally large events occur they may depress regional earthquake activity more than typical ruptures of the fault.

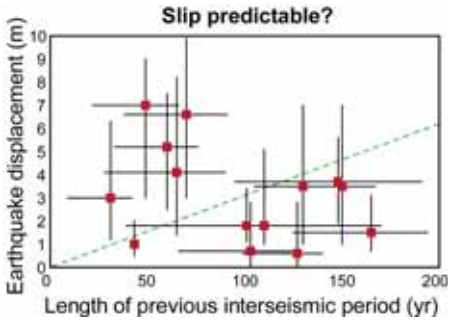

Figure 6. If the size of an earthquake depends upon the amount of time since the previous earthquake, all points should fall on the green dashed line. If there is any relationship, it appears that long intervals are followed by small displacements and short intervals are followed by a wide range of displacements (data from Table 1).

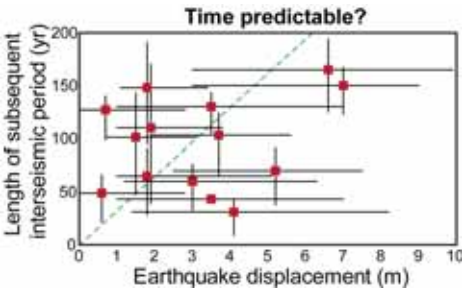

Figure 7. If the amount of time following an earthquake depends upon the size of the earthquake, all points should fall on the green dashed line. With the exception of the two largest earthquakes, it appears that there is a negative correlation, if any. The fact that the two largest earthquakes are followed by the two longest recurrence intervals may suggest that exceptionally large slip events depress fault activity (data from Table 1).

Implicit to our test of time and slip predictability is that strain accumulation is constant through time. The ~3 cm/yr average slip rate determined from the earthquake offsets matches the longer term geologic rate, the current geodetically determined strain accumulation rate, and the San Andreas' kinematically required fraction of the plate rate (e.g., Humphreys and Weldon, 1994; Powell and Weldon, 1992; Working Group on California Earthquake Probabilities, 1995). These similarities suggest that variations in strain accumulation rate on time scales relevant to the earthquake cycle are small and may be completely within the uncertainties of the different measurement systems. While some authors have suggested that strain accumulation rates can vary significantly through time (e.g., Romanowicz, 1993, Peltzer et al., 2001; Friedrich et al., 2003), at Wrightwood the strain accumulation rate would have to vary by more than an order of magnitude between individual seismic cycles and reach values triple the plate boundary rate to make the fault time or slip predictable (Fig. 8).

While we doubt that the strain accumulation rate varies so dramatically through time, the strain release rate certainly does. Variation in rate of strain release is best seen by looking at a cumulative plot of strain release through time (Fig. 9). Between ca. 600 and 900 A.D., strain was released at a rate of almost 9 cm/yr, ~3 times the average, and between 800 and 1900 A.D., the rate is just over 2 cm/yr. The high rate is due to both shorter than average recurrence intervals and larger than average displacements. Since the strain release rate between 600 and 900 A.D. is twice the entire plate boundary rate, it is hard to escape the conclusion that strain accumulated over many earthquake cycles was responsible for the flurry of large slip events and that a surplus of ~1 cm/yr has been accumulating since.

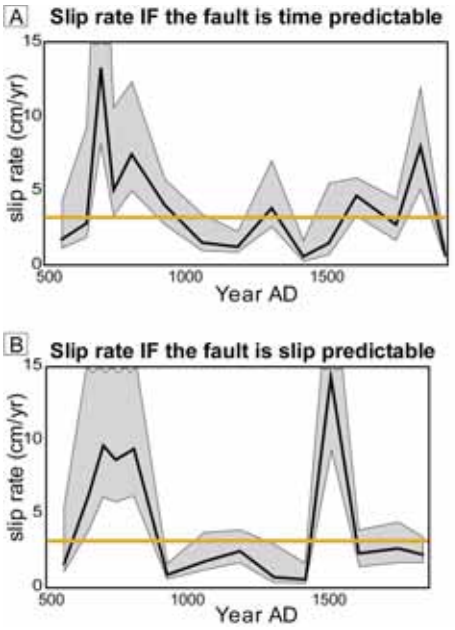

Figure 8. If the fault were time or slip predictable, the loading rate would have to vary by over an order of magnitude within 100s of years. Bold line is the calculated loading rate that would be required to accommodate (A) time and (B) slip predictable behavior (gray shading is ~1 sigma uncertainty; extreme peaks of uncertainty ranges are truncated). Orange line is observed average slip rate.

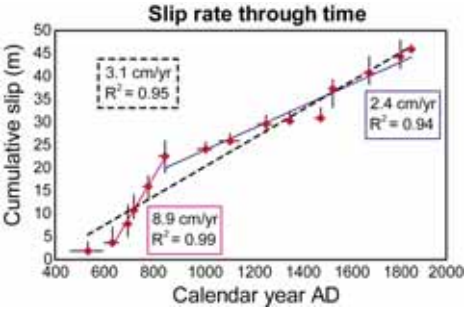

Figure 9. A plot of cumulative slip suggests variability that cannot be captured by considering individual seismic cycles. Between 600 and 900 A.D., the fault accumulated slip at three times the mean rate (black dashed line) or approximately twice the entire plate rate. Error bars show uncertainty in age and offset of individual events, not cumulative age or slip.

The magnitude and possible periodicity of the long-term cycling of strain can be seen by constructing a time line of the accumulation and release of strain

(Fig. 10). It appears that the range of relative strain is approximately the strain released in 4–5 average earthquakes, and a complete cycle could be ~1000 yr or 10 times the average recurrence interval. There appears to be no relationship between strain level and the size of earthquakes (a regression of relative strain level to displacement yielded an R^2 of 0.01). However, there does appear to be some relationship between the strain level and the interval between earthquakes (Fig. 11), although the relationship is dominated by the single longest interval, which occurred at the lowest observed strain level.

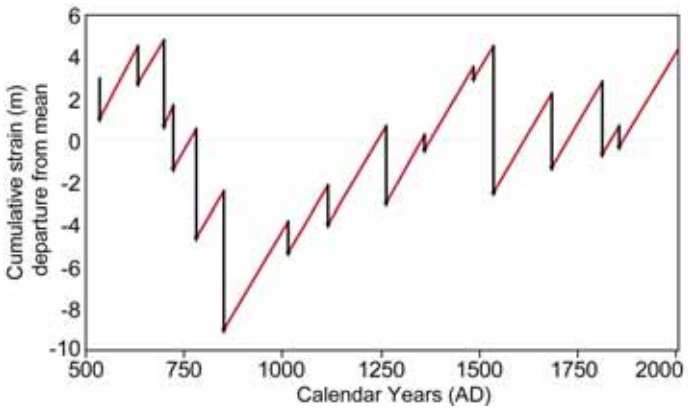

Figure 10. If the strain accumulation rate is the long-term slip rate, a record of the accumulation and release of strain through time can be constructed from earthquake ages and offsets (Table 1). Vertical drops (black arrows) are the release of strain during earthquakes (m of slip) and sloped portions (red lines) are strain accumulation between earthquakes at 3.1 cm/yr. Because the absolute strain level is unknown, we have set the mean value at zero. Periods of high relative strain appear to be followed by a large earthquake or a series of relatively large and frequent earthquakes. We are currently approaching the highest level of accumulated strain seen in the past 1500 yr.

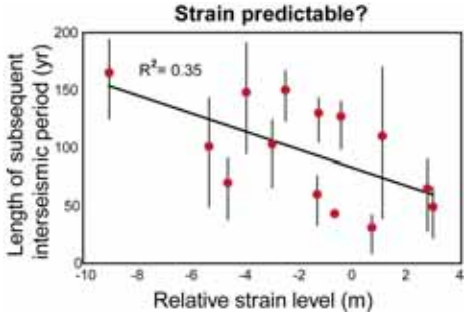

Figure 11. Recurrence intervals appear to be weakly predicted by the relative strain level at the beginning of the interval. If true, there could be as much as a factor of 3 variation in the average recurrence interval depending upon the cumulative strain level. Uncertainties are only shown in recurrence intervals because the relative strain level depends upon the cumulative slip and strain accumulation rate, which cannot be determined independently.

BEYOND WRIGHTWOOD

The most significant limitation to our analysis is that at a site like Wrightwood, we know only the displacements at that site, which may not be representative of the entire rupture. Ruptures decrease and may become more variable in displacement toward their ends (Hemphill-Haley and Weldon, 1999; Hecker and Abrahamson, 2004). Small displacements at Wrightwood may be small earthquakes or the tail ends of large ruptures (as in 1857) and large displacements may be 1857-sized ruptures that are centered nearby. To determine

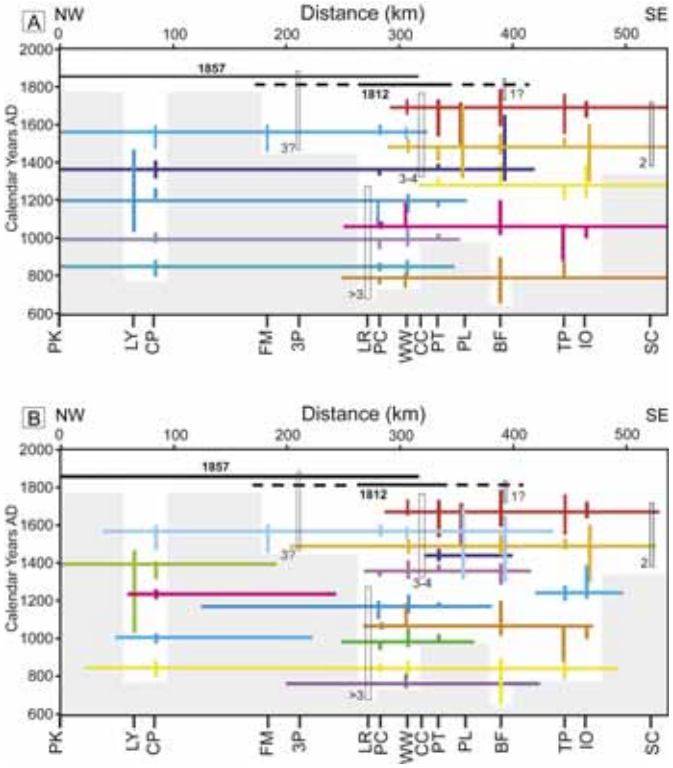

Figure 12. Two possible rupture sequences on the southern San Andreas fault. Vertical colored bars are ranges in age for earthquakes at the sites listed at the lower margin and horizontal bars are rupture lengths. Open boxes represent multiple event age ranges; the individual event ages are unknown. Grey shading indicates regions and times with no data. (A) In this model, the data are interpreted in terms of north and south ruptures with substantial overlap and the 1812 event is anomalous. (B) A random distribution of event timing and rupture lengths also appears to fit the data, suggesting the variability seen in the central part could be characteristic of the fault. Site abbreviations: PK—Parkfield; LY—Las Yeguas, Young et al. (2002); CP—Carrizo Plain, integration of Liu et al. (2004), Sims (1994), Grant and Sieh (1994); FM—Frasier Mountain, Lindvall et al. (2002); 3P—Three Points, reinterpretation of Rust (1982); LR—Littlerock, reinterpretation of Schwartz and Weldon (1986); PC—Pallett Creek, Salyards et al. (1992), Biasi et al. (2002), Sieh et al. (1989); WW—Wrightwood, Biasi et al. (2002), Fumal et al. (2002b), Weldon et al. (2002); CC—Cajon Creek, Weldon and Sieh (1985); PT—Pitman Canyon, Seitz et al. (2000), G. Seitz et al. (2003, personal commun.); PL—Plunge Creek, McGill et al. (2002); BF—Burro Flats, Yule and Sieh (2001), D. Yule and K. Sieh (2003, personal commun.); TP—Thousand Palms Oasis, Fumal et al. (2002a); IO—Indio, reinterpretation of Sieh (1986), Sieh and Williams (1990), Fumal et al. (2002a); SC—Salt Creek, Williams (1989), P.L. Williams (2003, personal commun.)

TABLE 1. EVENT AGES AND DISPLACEMENTS

Event	Mean age (1σ range)	Mean Interval	Offset (m; 1σ range) [†]
W1857	1857 (Historic)	44	1.0 (0.5–2.0)
W1812	1812 (Historic)	130	3.5 (1.0–7.0) [‡]
W3	1685 (1662–1700)	150	3.5 (1.0–7.0) [‡]
W4	1536 (1518–1542)	49	7.0 (3.0–9.0)
W5	1487 (1463–1502)	127	0.7 (0.0–2.8) [§]
PC-T[§]	1360 (1343–1370)	97	0.7 (0.0–2.8) [§]
W6	1263 (1230–1286)	148	3.7 (1.9–5.6)
W7	1116 (1071–1152)	101	1.8 (1.1–3.4)
W8	1016 (981–1039)	165	1.5 (0.7–3.1)
W9	850 (825–864)	70	6.6 (3.0–9.9)
W10	781 (758–794)	60	5.2 (2.5–7.5)
W11	722 (706–729)	31	3.0 (1.2–6.3)
W12	697 (676–708)	65	4.1 (1.4–8.2)
W13	634 (602–658)	110	1.8 (1.0–5.1)
W14	534 (464–594)	—	1.9 (1.0–3.8)

Note: Updated from Biasi et al. (2002), Fumal et al. (2002b), and Weldon et al. (2002). Approximately 2/3 of the intervals and 1/2 of the offset values are within 50% of their means (105 years and 3.2 m, respectively).

[†] It is impossible to quantify the uncertainty because determining offsets requires qualitative estimates of what is a "likely" match or geologic relationship. We estimate that this would be equivalent to a 50%–75% uncertainty range if it could be quantified.

[‡] While there are unique offsets of up to ~1 m each for 1812 and 1685, the best displacement data (7 ± 1 m) span both offsets, so we split the combined offset into two equal parts, and allow that all of the combined offset but 1 m can be caused by each earthquake.

[§] The Wrightwood site has a depositional hiatus at the time of event T at Pallett Creek to the northwest (Sieh et al., 1989) and event 4 at Pitman Canyon to the southeast (Seitz et al., 2000), so we infer that the event occurred at Wrightwood as well. We split the displacement observed between W5 and a hypothetical event that we assign the age of event T at Pallett Creek; we include a range that allows all or none of the displacement to be associated with each event.

how a complete rupture history modifies our understanding of fault behavior, we are actively building a complete space-time rupture history for the entire southern San Andreas fault. Figure 12 shows two end member rupture scenarios; in the first (A), prehistoric ruptures are constructed to be limited to either the northern two-thirds (as in 1857) or southernmost one-half (as in ca. 1685) portions of the fault. This scenario, first proposed by Weldon and Sieh (1985) and strongly supported by Fumal et al. (2002a), yields a quite periodic behavior of "northern" and "southern" events, with more random-looking overlap in between. However, the 1812 earthquake violates the pattern, and beyond the past 3–4 earthquakes, the extents of individual events are poorly defined. More irregular scenarios (e.g., Fig. 12B) are equally consistent with the data, so many more sites with much deeper records will be required before we can consider complete rupture sequences.

It is important to keep in mind that the offsets at a single site, like Wrightwood, represent the release of strain at that point and that strain release must balance accumulation over time, whether it occurs at the tails or middle of ruptures. Overlapping tails of essentially separate large ruptures may explain two small events in a short interval of time at a point, but this cannot explain the 600–900 A.D. flurry of four events with (on average) large displacements or the past 1000 yr of less-frequent, smaller-than-average events. Similar clusters of earthquakes are seen in most long earthquake records. For example, along the Cascadia subduction zone, the intervals between the last 12 earthquakes vary from a few hundred years to over 1000 (summarized in Witter et al., 2003). An even more remarkable cluster of events is seen in a 50,000-yr-long record of earthquakes from the Dead Sea Graben (Marco et al., 1996); based on stratigraphic arguments, intervals may vary by three orders of magnitude. There is no evidence for any relationship between interval lengths and displacement in these two records, although in both reports the authors caution that the proxies used to infer offset (subsidence at Cascadia and seismite thickness in the Dead Sea) may not be very sensitive to earthquake magnitude.

A synthetic series that contains a long-term pattern like Figure 10 was generated by Palmer et al. (1995) in a finite element model containing a strike-slip fault (like the San Andreas) and subparallel dip-slip faults. Infrequent slip on subparallel dip-slip faults modulated the timing of more frequent earthquakes on the large strike-slip fault because displacement on the dip-slip fault dramatically changed the normal stress on the strike-slip fault. While this may explain the long-term pattern, it doesn't explain the detailed relationship between interval and displacement because slip occurs at a defined ratio of shear to normal stress in the model, which appears unlikely at our site. Perhaps we need to consider more complex models that describe a large earthquake as a slip pulse (e.g., Heaton, 1990), whose timing is due to a stochastic-like growth from randomly occurring triggers, and whose displacement is controlled not just by the amount of accumulated strain but also intrinsic properties of the fault that vary over multiple seismic cycles.

CONCLUSIONS

Strain released in an earthquake is not simply that accumulated since the last earthquake. It appears likely that slip occurs at a wide range of strain levels and does not always release the same amount of strain or return the strain level to a fixed value after an earthquake. While it will remain difficult to say how typical our site is until there are long records of complete ruptures on the San Andreas and other faults, there can be little doubt that the simple renewal model of an elastic rebound driven seismic cycle will need to be expanded to accommodate variations that span multiple seismic cycles. If the Wrightwood record is representative of large earthquake behavior, conditional probability estimates will need to incorporate information beyond the randomly distributed variables currently used.

ACKNOWLEDGMENTS

We thank Joe Freitas and the Southern California Water Company of California for two decades of excavation and access, respectively, and too

many field assistants to list. K. Howard, D. Morton, T. Rockwell, R. Yeats, P. Molnar, and an anonymous reviewer provided comments that improved the manuscript. In addition, we appreciate discussions with G. Seitz, D. Schwartz, K. Sieh, W. Ellsworth, and D. Jackson that contributed to many of the ideas presented here. This work was supported by the U.S. Geological Survey (internal to T. Fumal and external grants 1434-93-G-2286, 1434-95-G-22532, 1434-97-HQ-GR-03117, 02-HQ-GR-0005, 04-HQ-GR-0042) and the Southern California Earthquake Center (NSF-EAR-8920136, PGE-024199#1, and 076548).

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Manuscript received April 13, 2004; accepted June 21, 2004. ✹

GSA Student Research Grant Program

2004 GSA Research Grant Recipients

The GSA Committee on Research Grants met at GSA headquarters in Boulder, Colorado, Saturday, March 27, and awarded $477,367 to 274 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 sixteen committee members for 2004 were Martin Goldhaber (chair), Michael Blum, Bruce E. Broster, Frank A. Corsetti, Rachael Craig, Eric Erslev, Steve Hasiotis, Barbara E. John, Claudia C. Johnson, Charles Nittrouer, Julia Sankey, Robert Shuster, Lisa Stillings, Scott Tyler, Carol Wicks, and Aiyun Zhang. As in previous years, the committee was pleased with the high quality of the research proposals submitted to the GSA Research Grants Program.

Outstanding Mention

The committee has recognized 13 of the proposals as being of exceptionally high merit in conception and presentation. This merit will be formally recognized by the Society at the President's Student Breakfast to be held at the annual meeting in Denver, Sunday, November 7, 7–8:30 a.m.

Philip Anderson, University of Chicago, for "Ecomorphological analysis of a Late Devonian fish fauna."

Yarrow L. Axford, University of Colorado—Boulder, for "Lacustrine records of 'Little Ice Age' climate in Iceland: Testing a new isotopic paleothermometer."

Madalyn Blondes, Yale University, for "Temporal-compositional trends in single-eruption sequences of the Big Pine Volcanic Field, California."

Alexander Bradley, Massachusetts Institute of Technology, for "Lipid biomarkers and fluid chemistry in modern hydrothermal ecosystems."

Isla Casteñeda, University if Minnesota—Duluth, for "A 22,000 year record of tropical paleoclimate and ITCZ variability from Lake Malawi, East Africa, based on bulk and molecular geochemical proxies."

Heather Gingerich, University of Waterloo, for "The Biogeochemistry of fluorine in the well waters of Oxford County, Ontario, Canada."

Jaime Goode, Colorado State University, for "Assessment of land-use impacts on forced-pool characteristics in constriction-dominated channels."

Scott Johnson, University of California at Santa Barbara, for "Supra-Barrovian metamorphism of allochthonous rocks, Hornelen region, Norway: Constraints on the Nordfjord-Sogn detachment zone."

Diana Latta, Lehigh University, for "Controls on cyclicity and encoding of climate through rock magnetic properties in Aptian age platform carbonates, northeast Mexico."

Kira Lawrence, Brown University, for "Evolution of Pliocene Atlantic meridional temperature gradients."

Lee-Hsiang Liow, University of Chicago, for "Are geologically persistent taxa morphologically and ecologically special? Trachyleberidids s.l. (Ostracoda) as a case study."

Heather Sanders, Ohio University, for "Diversity of Cretaceous conifers: Anatomically preserved shoots with attached pollen cones from the Barremian of British Columbia, Canada."

Owen Sherwood, Dalhousie University, for "Amino acid dating of deep sea gorgonian corals: Their use in Holocene paleoceanography."

New in 2005!

Starting in 2005, the GSA student research grant application process will be available online. Although the current forms will not change significantly in nature, the process for submitting applications and appraisal letters will be accessible online only though GSA's Web site. No paper applications or letters will be accepted. Please check GSA Connection, GSA's Web site (www.geosociety.org/grants/gradgrants.htm), and upcoming e-mails each month for updates.

The deadline for proposal submission will be midnight, February 1, 2005.

GSA Student Research Grant Program

2004 Student Research Grant Statistics

Total proposals received	585
Total proposals funded	274
Total dollars awarded	$477,367
Average request	$2,429
Average award	$1,742

2004 Partial List of Funding Sources

Penrose Endowment	12,000
Joseph T. Pardee Memorial Fund	202,619
Harold T. Stearns Fund	3,000
Partial GSA Funding	**$218,619**

Total National Science Foundation Funding	**$159,100***

Geophysics Division	1,300
Hydrogeology Division	2,000
Structural Geology and Tectonics Division	3,600
Sedimentary Geology Division	1,000
Total Division Funding	**$7,900**

Blechschmidt Fund	1,100
Cox Fund	1,250
Dillon Fund	2,400
Geostar Fund	6,000
Greatest Needs Fund	40,000
Lipman Fund	3,600
Minority Fund	1,400
Montage Fund	550
Reed Fund	1,750
Research Fund	8,000
Ross Fund	1,800
Sisson Fund	2,150
Subaru Outstanding Woman In Science/Curtis Fund	4,000
Snavely Fund (new in 2004)	1,500
Terman Fund (new in 2004)	5,000
Wanek Fund	2,800
Total GSA Foundation Funding	**$ 83,300**

*NSF grant matched at least 2 to 1 by GSA and GSA Foundation.

Student Recipients of Special Awards in 2004

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 2004 recipient is **Kira Lawrence,** Brown University, for "Evolution of Pliocene Atlantic meridional temperature gradients."

John T. Dillon Alaska Research Award

The John T. Dillon Alaska Research Award honors the memory of Dillon, who was particularly noted for his radiometric age-dating work in the Brooks Range, Alaska. Two areas which serve as guidelines for selection of the award are field-based studies dealing with the structural and tectonic development of Alaska, and studies which include some aspect of geochronology (either paleontologic or radiometric) to provide new age control for significant rock units in Alaska. The 2004 recipient is **Erik Katvala,** University of Montana, for "Carboniferous to Permian sequence biostratigraphy of the Alexander and Wrangellia terranes."

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 2004 recipient is **Jaime Goode,** Colorado State University, for "Assessment of land-use impacts on forced-pool characteristics in constriction-dominated channels."

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 2004 recipient is **Madalyn Blondes,** Yale University, for "Temporal-compositional trends in single-eruption sequences of the Big Pine Volcanic Field, California."

Bruce L. "Biff" Reed Scholarship Award

The Bruce L. "Biff" Reed Scholarship Fund was established to provide research grants to graduate students pursuing studies in the tectonic and magmatic evolution

(*continued on page 14*)

GSA Student Research Grant Program

(*Special Awards, continued from page 13*)

of Alaska primarily, and also can fund other geologic research. The 2004 recipient is **Shaun Brown,** University of South Carolina, for "Magma genesis and evolution of Little Sitkin volcano, Aleutian Islands, USA."

Alexander Sisson Research Award

Family members of Alexander Sisson established a fund in his memory to promote and support research for students pursuing studies in Alaska and the Caribbean. The 2004 recipient of the award this year is **Ian Miller**, Yale University, for "Paleofloral constraints on the displacement of suspect terranes: Application to the Yakutat Block, Alaska."

Harold T. Stearns Fellowship Award

Harold T. Stearns established the Harold T. Stearns 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 two candidates. They are **Keegan Fengler**, Central Washington University, for "Paleoseismic investigations of the Rueisuei segment of the Longitudinal Valley fault near the Anding Bridge, Longitudinal Valley, eastern Taiwan," and **Mirela Dumitrescu**, Indiana University, for "Reconstruction of seawater surface paleotemperatures during the Early Aptian at Shatsky Rise, west central Pacific, based on a novel geochemical proxy, the TEX86 index."

John Montagne Fund

The John Montagne Fund was established in 2000 to support one recipient's research in the field of quaternary/geomorphology. The 2004 recipient is **Anne Jefferson**, Oregon State University, for "Drainage development on highly permeable basaltic lavas of the Oregon Cascades."

Alexander and 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 2004 recipient is **Peter Druschke**, University of Nevada—Las Vegas, for "The paleogeography, tectonic setting and petroleum source rock characteristics of the Paleogene Sheep Pass and Elko Formations, Nevada."

Charles A. and 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 sea-floor 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 2004 recipient is **Philip Anderson**, University of Chicago, for "Ecomorphological analysis of a Late Devonian fish fauna."

Parke D. Snavely, Jr., Cascadia Research Award Fund

The Parke D. Snavely, Jr., Cascadia Research Award Fund provides $1,500 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 2004 recipient is **Tovah Bayer**, Western Washington University, for "Quantification of suspended load and mineralogical analysis of Swift Creek landslide, northwest Washington."

Interested in improving your chances of receiving a GSA student research grant?

Looking for tips to improve your proposal writing for future funding?

Announcing GSA's first research proposal writing workshop!

At the annual meeting in Denver, GSA will host its first proposal-writing workshop aimed specifically at graduate students. This workshop will be led by a member of the GSA Research Grant Committee and will be tailored to new and returning student members looking for tips on proposal writing. The instruction will be based on recent GSA graduate research grant proposals and will put several examples into hypothesis-driven studies providing examples of the dos and don'ts to the proposal-writing process.

The workshop will be free; however, the number of participants will be limited by the size of the room. Please see the GSA Web site (www.geosociety.org/meetings/) or the October issue of *GSA Today* for more details.

Other Applicants Recommended for Funding

A

Jeff Agnew, Anthony Albrecht, Allison Alivia, Eric Anderson, Charles Angerman, Beth Apple, Brittina Argow, Maria Arpa, Miriam Attenoukon, Nicholas Austin

B

Matthew Bachmann, Danielle Bailey, Margaret Anne Baker, Sophie Baker, Austin Baldwin, Elspeth Barnes, Wendy Barrow, Alexander Bartholomew, Daniel Behringer, Todd Belanger, Michael Benjamin, Nicholas Beyrle, Ryan Bierma, Katie Binetti, Jessica Black, Joan Blainey, Mehgan Blair, Andrea Blecha, Heather Bleick, Jennifer Bobich, Amanda Booth, Matthew Bourke, Niki Bowerman, Diana Boyer, Amy Brock, Kristina Brody, Brendan Brown, Daniel Brown, Shaun Brown, Andrew Bruening, Olivia Buchan, Reed Burgette, Benjamin Burke, Melinda Buyck

C

Julie Calkins, Anders Carlson, Charles Carrigan, Brad Carter, Deron Carter, Andrew Caruthers, Gareth Chalmers, Lauren Chetel, Matthew Clapham, Jennifer Cooper, Stacey Corrie, Brad Cramer, John Crawford, Adam Csank, Andrew Czaja

D

Michelle Davidson, Edward Davis, Joost De Moor, Linnae Decamp, Sara Decherd, Seth Dee, Catherine Denoncourt, Aaron Diefendorf, Jason Downs, Sarah Doyle, Joy Dunham, Beth Duschatko

E

Megan Elwood-Madden, Nathan English, Saskia Erdmann, Frank Evans

F

Juraj Farkas, David Farris, Aaron Feggestad, Lee Florea, David Fortin, Kurt Frankel, T.J. Fudge

G

Parham Gardner, Emily Geraghty, Robert Gillis, Melissa Giovanni, Eric Goergen, Beverly Goodman, Warren Grice, Wesley Groome, Todd Grote, Michele Gutenkunst, Jerome Guynn

H

Elizabeth Hajek, Tristram Hales, Benjamin Hallett, Lee Harrison, Lauren Hassler, Richard Heermance, Noel Heim, Dan Hembree, Jonathan Hendricks, Austin Hendy, Alissa Henza, David Heuer, Jane Hill, Eric Horsman, Jennifer Horwath, Michael Hren, Michael Hsieh, Zhenzhen Huang, Adrian Hughes, Patrick Hughes, John Huntley

J

Keith Jackson, Benjamin Jacobsen, Catherine Jamet, Micah Jessup, Shelley Johnston, Heather Jones, Vena Jones

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Talia Karim, Dawn Kellett, David Kennedy, Andrew Kenst, Lawrence Kiage, Johanna Kieniewicz, Sang-tae Kim, William Kinman, Alan Kobussen, Whitney Kocis, Brian Kraatz, Seth Kruckenberg, Joseph Kula

L

Todd Lamaskin, Robin Lancaster, Chandra Lawler, Heidi Luchsinger, Festo Lugolobi, Ranie Lynds

M

James MacDonald, Timothy Macintyre, Rob Mackley, Daniel Macphee, Ali Maga, Edward Majzlik, Daniella Makram Morgos, Pedro Marenco, Jared Marske, Linda Martin, Matthew Massey, Samuel Matson, Ryan McLin, Mike McTeague, Cory McWilliams, Michael Meredith, Joseph Michalski, Christine Missell, Katty Mobasher, Anja Mueller, Scott Muggleton, Abhijit Mukherjee, Cara Mulcahy, Kathleen Muldoon

N

Cheryl Nazareth, Thomas Neely, Tin-wai Ng, Katherine Nicholson, Tye Numelin, Torrey Nyborg, Geraldine Nzokwe

O

Colin O'Farrell, Kathryn Oheim, Michael O'Neal, Alberto Orozco, Quintin Overocker

P

Jeffrey Parker, Doreena Patrick, Bianca Pederson, Daniel Peppe, Morgan Perrone, Michael Petronis, Julie Pett-Ridge, Jennifer Phillippe, Jeff Pollock, Pete Probst, Michael Procsal

R

Yasmin Rahman, Sushmita Ray, Byrdie Renik, Alberto Reyes, Justin Richardson, Paul Rindfleisch, Matthew Rioux, John Rissetto, Janiel Rivera, Lizzette Rodriguez, Dylan Rood, Jeffrey Rosaler, Adam Rountrey, Christen Rowe, Michael Rowe

S

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T

Akinori Takeuchi, Pamela Gerrez Taneza, Jennifer Teerlink, Kathryn Thomas, Svetoslava Todorova, Alexandru Tomescu, Justin Tweet

U

Sandra Underwood

V

Jennifer Van Pelt, Vandana Vandanapu, John Vanden Brooks, Melanie Vining, Mindy Sue Vogel, Matthew von der Ahe

W

Amanda Waite, Gang Wang, Xianfeng Wang, Nicholas Waterson, Caroline Webber, Amy Weislogel, Jessica Whiteside, Brooke Wilborn, William Wilcox, Pamela Willard, Russell Willis, Laura Wilson, Aaron Wood, Christopher Wurster

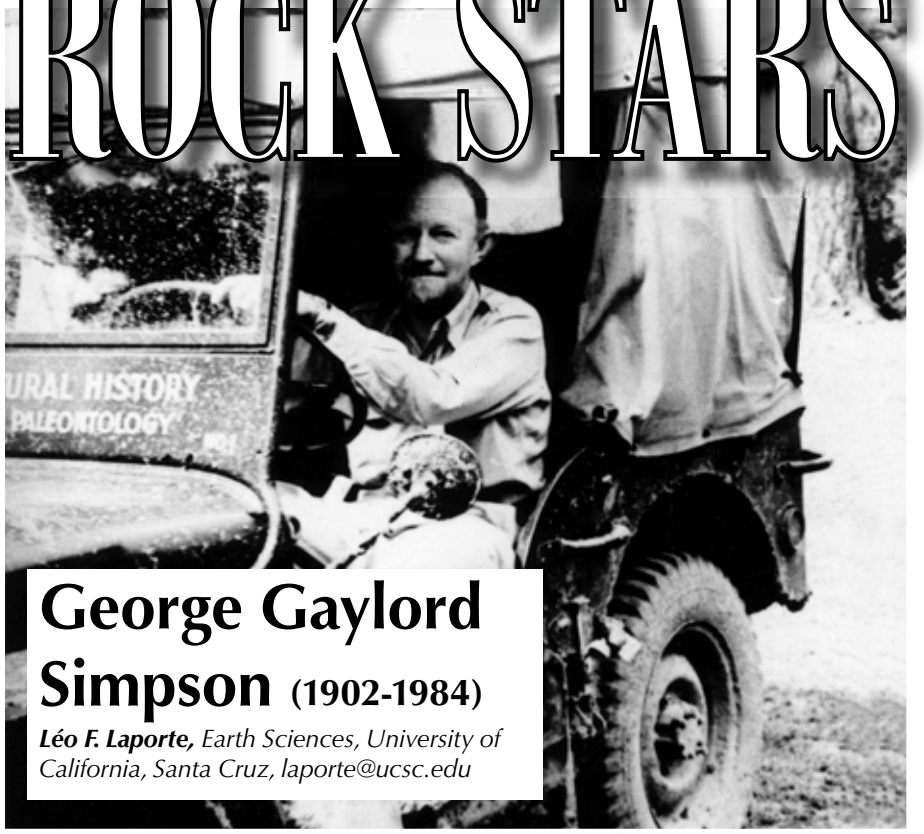
Y

Grant Yip

Z

Grant Zazula, Kate Zeigler, Gengxin Zhang, Liqiong Zhang, Ruixuan Zhao, Liming Zhu, Nathan Zimmerman

ROCK STARS



George Gaylord Simpson (1902-1984)

Léo F. Laporte, *Earth Sciences, University of California, Santa Cruz, laporte@ucsc.edu*

George Gaylord Simpson in the early 1950s. He claimed that "field work was the next best thing in life after a loving wife"—his, of course.

What motivates a person to pursue a career in science? The distinguished American paleontologist, George Gaylord Simpson, claimed "Nothing learned [in high school] had any bearing at all on the big and real questions. Who am I? What am I doing here? What is the world? What is my relationship to it?" Later, in college, he had come to the conclusion that "life is the most important thing about the world, the most important thing about life is evolution."

Such motivating questions inspired Simpson's lifelong study of the history and evolution of life on Earth. By the late 1930s and early 1940s, Simpson, though relatively young, was already a distinguished paleontologist at the American Museum of Natural History in New York City. His achievements included a Yale doctorate in geology, research position at the British Museum, leadership of two fossil-collecting expeditions to Patagonia, two books, and more than one hundred scientific articles and monographs—all topped off by election to the National Academy of Sciences and the American Philosophical Society.

Before leaving for military service in 1942, Simpson completed a major text, *Tempo and Mode in Evolution*, published two years later, that applied the concepts and conclusions of the new discoveries in genetics to the extensive fossil evidence of life's long history. He claimed that the small-scale "microevolution" of the geneticist could adequately explain the large-scale "macroevolution" of the paleontologist, thereby validating the usefulness of fossil evidence for addressing evolutionary questions.

Early Life

Simpson was born in Chicago, on 16 June 1902, the only son and third child of his attorney father and missionary-raised mother. His Scots ancestry and missionary background led to a strict Presbyterian upbringing. By age nine, Simpson was made a formal member of the church but soon after "deconverted" when he decided in a fit of childish peevishness that he "did not want to forsake forever being naughty."

At about the same time, he talked his parents into purchasing the *Encyclopedia Britannica*, which he read straight through. "I think it gave me my first conception of the world of learning as a whole, my first definite feeling for organized facts, and my first inkling of how to go systematically about finding out such facts."

University Years

After skipping several years in school, Simpson at age 16 entered the University of Colorado at Boulder in the fall of 1918. He thought perhaps he wanted to be a creative writer, but in his second year he enrolled in a geology course and was quickly converted, in part because of the enthusiasm and encouragement of his instructor, Arthur Tieje, the first teacher who recognized and challenged his formidable intellectual abilities. In his senior year, Simpson transferred to Yale, because Tieje advised him that if he wanted to be a geologist and paleontologist, Yale was the best place to study. Perhaps additional reasons for the transfer were his not getting the editorship of the college humor magazine he helped start and—insult added to injury—the new editor then stealing his girlfriend.

After graduation, Simpson stayed on at Yale for his doctoral studies where, in the basement of the Peabody Museum, he discovered a large collection of primitive mammals from Mesozoic age rocks of the American West that he wanted to study for his doctoral dissertation. But his advisor, Richard Swann Lull, told him that "those fossils are much too important…very delicate and highly significant…for a young graduate student."

First Field Work

At the end of his first year of graduate work, Simpson obtained a position prospecting for Tertiary mammals in Texas and New Mexico as a field assistant to William Diller Matthew, chairman of the department of paleontology at the American Museum. Matthew was one of the leading paleomammalogists, particularly known for his research on Cenozoic mammals and for his book *Climate and Evolution* (1915). He was also a leading student of horse evolution. By the end of the summer, Simpson had shown himself to be an energetic and highly successful field man, having made two unique fossil discoveries. The first was the skull of an important link between ancestral Pliocene and modern horses. The second was the skull, backbone, and rib cage of a Miocene "dog-bear," a heavy, large, doglike carnivore.

Lull was suitably impressed by these discoveries and permitted Simpson to study the Mesozoic-age mammals after all. Matthew, too, was enthusiastic, for he became Simpson's informal off-campus advisor for his dissertation and

later an advocate for his subsequent appointment at the American Museum.

But, in the beginning, the search for fossils that summer was hardly promising. As Simpson wrote to his sister Martha, "I've been digressing all over the landscape.… Now & then we find a fossil—every third day or so, if small fragments count.…Poor Dr. Matthew gets madder & madder [:] 'First…formation in which I couldn't find mammals.'" Part of Matthew's chagrin was no doubt due to Simpson's initial clumsiness. Matthew had found some important horse teeth and, after treating them with shellac, laid one of them on the ground to dry. Simpson promptly stepped on the tooth, breaking it into several pieces. Matthew glowered, telling Simpson, "Go stand over there," and didn't talk to him for several hours. But by the next day the incident was forgotten.

Simpson received his Yale Ph.D. in 1926 and went to the British Museum of Natural History in London to continue his study of the then little-known, primitive mammals by examining British and European counterparts. The subsequent two publications of his Yale research on American Mesozoic mammals and on the British Museum fossils quickly established his paleontological reputation.

American Museum of Natural History

On his return from England in the fall of 1927, Simpson joined the American Museum as assistant curator of fossil vertebrates, assuming a position left vacant when Matthew moved to the University of California at Berkeley. In the late 1930s and early 1940s, Simpson's work turned more theoretical as he shifted his attention to more general problems of evolution rather than focusing solely on fossil mammals. Simpson published *Quantitative Zoology*, co-authored with his second wife Anne Roe, and he completed two book-length manuscripts, *Tempo and Mode in Evolution*, and *Principles of Classification and a Classification of Mammals*. He also managed to publish a picaresque travel narrative of his first paleontologic expedition to Patagonia in the early 1930s where, upon arrival in Buenos Aires, he found himself in the midst of a revolution, barely escaping with his life.

In 1942, the new director of the American Museum was contemplating major departmental reorganization by putting the zoologists working with living groups with the paleontologists studying their corresponding fossils. Simpson resisted this plan and considered leaving the museum altogether. Instead, he enlisted in the U.S. Army in December 1942, and was made a captain in military intelligence. He surprised his superiors by completing a six-week course in intelligence methods in a single week. He shipped out to North Africa, later moving on to Sicily and Italy, until 1944, when he was sent home with a severe case of hepatitis. By then, he held the rank of major and had been awarded two Bronze Stars.

When Simpson returned to the museum, the controversial reorganization plan had been scrapped and a more attractive plan was imposed, which included a department of geology and paleontology of which he was named chairman. He also accepted an appointment as professor of vertebrate paleontology at Columbia University. In 1949, Simpson published a popular account of modern evolutionary theory from the point of view of the fossil evidence, *The Meaning of Evolution*, which was subsequently translated into ten languages and sold some half-million copies. In 1958, he resigned the department chairmanship and soon after left for the Museum of Comparative Zoology and Harvard University.

The centennial of Darwin's *On the Origin of Species* in 1959 not only signaled a fresh start for Simpson at Cambridge, but also brought him further into the limelight as a leading evolutionist. Conferences and symposia marked the centennial, with Simpson often present either as a contributor—as in Chicago where he gave a keynote public lecture at the meeting of the American Association for the Advancement of Science, titled "The World into Which Darwin Led Us"—or as an honoree—as in London where he received the Darwin-Wallace Commemorative Medal from the Linnaean Society, in whose meeting rooms Charles Darwin and Alfred Russel Wallace first announced their theory of natural selection a century earlier. Nor was Simpson ignored at home: in February 1966, he received the National Medal of Science from President Lyndon B. Johnson.

Final Years

In 1967, Simpson and his wife Anne Roe retired to Tucson, Arizona. He continued to work for the next decade and a half in a small building next to his house, surrounded by his research files and extensive personal library, walls and surfaces scattered with honorary degrees, photographs from the past, and replicas of the many scholarly gold medals he had been awarded.

In the last years of his life, Simpson had become a memory from the past, as often happens, even to the most distinguished of scientists. Most thoughtful students of paleontology and evolution were aware of what Simpson had contributed, but now took it for granted. They looked instead to the writings of younger paleontologists and evolutionary biologists for new ideas. In a way, Simpson had outlived his fame, and had become a living, mostly ignored monument of what had come before. A hint of his state of mind is revealed in a posthumously published work of science fiction (*The Dechronization of Sam Magruder*, St. Martin's Press, 1996). Simpson tells the story of Sam Magruder, who was experimenting on the "quantum theory of time-motion" in 2162 A.D. when he suffers a "time-slip" that puts him back in the Late Cretaceous of New Mexico. Helplessly lost in time and with no hope of returning to the present, Magruder ekes out a primitive existence for some years until a fatal accident befalls him. Before his death, Magruder manages to chisel out his experience and philosophy of life on eight rock slabs that are recovered many millions of years later, and so his story becomes known.

Always more comfortable in expressing his views in writing than in speaking, Simpson appears to use this work of science fiction to reveal his own, mostly melancholy, views about life's meaning and purpose, the importance of adapting to the here-and-now, and how historical contingency controls subsequent outcomes. Was Simpson speaking for himself when Magruder declares "My real purpose in engraving these slabs is a search for comprehension…I am exploring my own nature"?

In the summer of 1984, Simpson contracted pneumonia during a South Pacific cruise and was in and out of the hospital several times over the next few months. He finally succumbed on the evening of Saturday, 6 October 1984, at the age of 82. His remains were cremated and dispersed in the Arizona desert.

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Laporte, L.F., editor, 1987, Simple Curiosity: Letters from George Gaylord Simpson to his Family, 1921–1970, University of California Press.

Laporte, L.F., 2000, George Gaylord Simpson—Paleontologist and Evolutionist: Columbia University Press.

See also http://people.ucsc.edu/~laporte/simpson/Index.html (case sensitive).

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

GSA Foundation Update

Donna L. Russell, *Director of Operations*

Welcome, Dave!

Susan M. Landon*, Interim Foundation Chair*

David Stephenson

David A. Stephenson, GSA Past President (1994–1995) and longtime supporter of GSA, is joining the GSA Foundation as its president. Dave will work with the Trustees, Donna Russell, and Joan Bell to continue building the success of the Foundation.

Dave has worked in academia, governmental agencies, and consulting. He will continue to work half time for the consulting firm, Leggette, Brashears & Graham, in Jackson, Wyoming. In 1979, Dave entered the consulting field and served as director of various hydrogeology groups for national and international consulting firms. In 1989, he founded his own consulting firm, South Pass Resources, Inc., in Scottsdale, Arizona, specializing in senior review and hydrogeology.

In describing success in the consulting industry, Dave says, "Success requires not only strong technical skills (the ability to observe, record, and interpret geologic data accurately), but also business and marketing savvy, the ability to communicate effectively your findings (both verbally and in writing), project management capabilities (organizational skills), and the ability to work as part of an interdisciplinary team."

Dave's skills developed in his successful consulting work and his business and marketing savvy will be a tremendous benefit to the Foundation. Dave's service to GSA will also be a great benefit. After his term as GSA president, Dave continued to return to Boulder frequently as interim executive director until Jack Hess was hired to lead headquarters. The Foundation Trustees are very pleased that Dave will be joining our team and are looking forward to working with him to continue to build financial support for GSA and its programs. He has an excellent background in business and an in-depth understanding of GSA and its programs—a combination that will benefit GSA and the GSA Foundation.

Dave has a Ph.D. in geology and hydrogeology (University of Illinois), an M.S. in geology (Washington State University), and a B.A. in geology (Augustana College). He worked for the Illinois State Geological Survey and the Desert Research Institute in Reno, Nevada, before joining the faculty of the University of Wisconsin—Madison, Department of Geology and Geophysics. For 14 years, he was professor of geology and hydrogeology, and he also served as director of the Water Resources Management Graduate Degree Program.

Dave has shown a dedication to our profession and has served in many capacities outside of GSA. He has been a member of several National Research Council committees and has served as a program advisor at the Oak Ridge National Laboratory and for several university geoscience programs. He served as president of the American Geological Institute from 1997 through 1998.

The GSA Foundation was established in 1980 to seek financial support for Society initiatives, and in the past 21 years, it has supported educational programs including research grants, the Decade of North American Geology project, and public outreach efforts.

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Got an Item for Our Auction?

The GSA Foundation is seeking items for its Silent Auction to be held during the GSA Annual Meeting in Denver in November. Proceeds from the auction will be designated for GSA's "Greatest Needs." Last year, the Foundation Auction raised about $13,000, which was used by the Foundation to support student travel grants to GSA meetings—both domestic and international—and student research grants. Help us make this year's auction even more successful. If you have something you would be willing to donate to this fun event, it will directly help a number of GSA programs.

Here's how it works: You can donate items such as rare geologic books, geologic software, fossils, mineral specimens, jewelry, rare geologic maps, wine, field supplies, and antiques, just to name a few. **You also can donate your time in a timeshare or vacation property**. Last year, bidders enthusiastically pursued timeshares from a variety of places around the country.

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

The auction begins the evening of Sunday, November 7, and concludes on Wednesday, November 10. Please help us with your donation for the auction. And stop by the Silent Auction Room in the Foundation booth during the Annual Meeting to join in the bidding and fun!

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

A BLOSSOMING MENTOR PROGRAM

Karlon Blythe, *GSA Outreach Program Officer*

In the spring of 2004, the two pilot programs for the Section Meeting version of the new John Mann Mentors in Applied Hydrogeology Program were rolled out at the combined Northeast-Southeast Sections Meeting in Tyson's Corner, Virginia, and at the combined Rocky Mountain–Cordilleran Sections Meeting in Boise, Idaho. As a result of the completed test phase, the Section Meeting version of the Mann Program will be tweaked to occur as an early dinner event and offered at each 2005 Section Meeting.

The Mann Mentor Programs at both Section and Annual Meetings were designed for students whose career choice is hydrology or hydrogeology. Thanks to the generosity of the late John F. Mann, these students have the privilege of sitting down over a free meal and talking one-on-one with distinguished practicing professionals whose career choice reflects that of the students. At Section Meetings this spring, these relaxed, focused, and deliberately small-scale events brought appreciative comments from the students.

- "The most valuable aspects (of the Mann Program) were learning about what employers expect at interviews and what training you should have. Plus, learning what employers are looking for in a new hire."
- "Talking with professionals who work in a wide variety of companies was a great experience. Hearing their advice and outlook on hydrogeology was extremely valuable. I picked up some tips and learned different things from each mentor."
- "I liked the one-on-one contact. The small size of the meeting meant that there was two-way interaction and not simply listening to someone talk."

For Denver's Meeting, the Mann Program moves to its alternate Annual Meeting format. This Mann Program arrangement will enable 25 qualified students to receive a coveted FREE ($33 value) ticket to the prestigious Hydrogeology Division Luncheon and Awards Presentation where networking opportunities abound. To qualify for an e-mail invitation to receive a ticket, students must be registered online for the GSA Annual Meeting in Denver by September 30, 2004, and they must have previously ticked off the Hydrology or Hydrogeology box on their GSA membership applications.

The 2004 Mentors for the John Mann Mentors in Applied Hydrogeology came from private and public businesses and government agencies. They represented a broad range of backgrounds, education, experience, and expertise. Their common links? Water and the desire to give back to their profession.

If you are interested in participating as a mentor at a GSA 2005 Section Meeting, please contact Karlon Blythe, kblythe@geosociety.org.

The John Mann Mentors in Applied Hydrogeology Program gratefully acknowledges these mentors for their individual gifts of time and for sharing their insight with GSA's student members.

Carter Borden
DHI Incorporated, Boise, Idaho

Mark W. Eisner
Advanced Land & Water, Inc.
Sykesville, Maryland

Jack R. Harrison
HyQual, Boise, Idaho

Hugh A. Hurlow
Utah Geological Survey
Salt Lake City, Utah

Todd R. Kincaid
Hazlett-Kincaid, Inc.
Reno, Nevada

Patrick Leahy
U.S. Geological Survey
Reston, Virginia

Kimberly McGeehan
Weston Solutions, Inc.
Abingdon, Maryland

Christian Petrich
SPF Water Engineering, LLC
Boise, Idaho

Larry N. Smith
Montana Bureau of Mines and Geology
Butte, Montana

2004–2005 CONGRESSIONAL SCIENCE FELLOW NAMED

Sarah Noble

Sarah Noble has been appointed as the GSA–U.S. Geological Survey Congressional Science Fellow for 2004–2005. Noble, who was born and raised in Minnesota, earned a B.S. in geology from the University of Minnesota—Twin Cities in 1998. As an undergraduate, she became very interested in the relationship between science and policy and so also found time to earn a minor in political science with a focus on environmental policy.

Noble recently received her Ph.D. in geological sciences from Brown University, where she worked as both a teaching and research assistant. She also earned a NASA Graduate Student Researchers Fellowship. Active in Brown's student government, Noble served as the graduate representative to the geosciences department faculty for two years and spent three years as the Geology Department Representative to the Graduate Student Council. Her work in the planetary geology group at Brown focused largely on understanding the consequences of "space weathering"—the physical and optical effects of exposure of a planetary surface to the space environment. Not content to focus on just one planet, her dissertation includes chapters on the Moon, Mercury, the Asteroids, and Mars.

Noble's main political interests include NASA missions and funding. "With President Bush's new initiative for space exploration, NASA's future has been a very hot topic of late, and it seems that the decisions that will be made in the coming months are going to be critical for deciding the fate of space exploration for decades," says Noble. "I can't imagine a more exciting time to have an opportunity to become involved in space policy." Other science and policy issues she hopes to become involved with include science funding, global climate change, and science education.

Noble considers it a great honor to be chosen as the GSA-USGS Congressional Fellow and sees it as a rare opportunity to work closely with our government and our country's leaders. She hopes to gain an insider's perspective on the difficulties and challenges faced by our leaders and to find opportunities to take this knowledge back to her fellow scientists, as well as to reach out to students and the general public.

Call for Applications:

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

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

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

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

Deadline to apply: January 21, 2005

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

Celebrate EARTH SCIENCE WEEK

October 10–16, 2004

Ann Benbow, Director of Outreach and Education, American Geological Institute

Earth Science Week is a time when geoscientists around the world will be sharing their knowledge and love of earth science with their communities. Earth Science Week was established by the American Geological Institute in 1998 to raise awareness of earth and environmental sciences and their importance to society. During this week, geoscientists work with students and the general public to help them discover the earth sciences and become engaged in scientific exploration.

The theme for Earth Science Week 2004 is "Living on a Restless Earth." The global community is affected by the restless nature of our planet every day. Natural hazards such as earthquakes, storms, volcanoes, and landslides threaten our homes and businesses, but they also provide evidence of the incredible power and beauty of our planet. Earth scientists study dramatic phenomena such as these to understand their causes and minimize their impacts on society. You can share your knowledge and enthusiasm about our dynamic Earth with others by getting involved in Earth Science Week.

There are many ways to celebrate. Teachers and students explore earth science with activities and experiments or by having scientists visit their classrooms. Museums and science centers host earth science exhibits, and field stations and university departments hold open houses for the public. In 2003, earth scientists and educators organized more than 200 events in all 50 states and in nine additional countries.

Your participation can be as simple as sending an Earth Science Week kit to a science teacher you know. The kits contain classroom activities, a teacher's guide, posters, bookmarks, and other materials that help teachers celebrate the week in classrooms. For more information about Earth Science Week, and to find out how you can get involved, visit www.earthsciweek.org.

2004 Gladys W. Cole and W. Storrs Cole Memorial Research Awards

The 2004 Cole Awards for Postdoctoral Research were funded by the GSA Foundation. $8,000 from the **Gladys W. Cole Fund** for research in geomorphology of semi-arid and arid terrains was awarded to **J. Elmo Rawling III**, University of Wisconsin—Platteville, for his research project "Quaternary Development of the South Dakota White River Badlands." $7,300 from the **W. Storrs Cole Fund** for research in invertebrate micropaleontology was awarded to **Catherine Stickley**, Cardiff University, for her research project "Diatom biostratigraphy of Eocene sediments from the Tasmanian Gateway, Southern Ocean."

What's So Hard About Keeping Meeting Costs Down?

FAQs on Hotels from the GSA Director of Meetings

***Tammy White**, GSA Director of Meetings*

During my tenure as director of meetings, many of you have asked me about hotel selection and pricing as they pertain to the GSA Annual Meeting. Contracting hotel arrangements for a meeting of 6,000–7,000 is a complex process, and the issues become more confusing when the needs and interests of all parties—from GSA and our diverse individual members and attendees, to large and small hotels, cities, and convention bureaus, to agents and travel providers—must be considered.

We know that all attendees are looking for that perfect balance of quality, comfort, convenience, and affordability in their hotel accommodations. GSA strives to achieve this balance at every GSA meeting. While the following explanations pertain primarily to the Annual Meeting, the same issues also come into play in planning GSA Section and specialty meetings.

Some definitions to lay the groundwork:

GSA official (contracted) hotel: A hotel with which GSA has contracted reserved meeting space and/or sleeping rooms for its meeting.

Room block: The number of hotel sleeping rooms an organization reserves via contract and guarantees will be occupied by its meeting attendees.

Attrition: Hotels place a hold on sleeping rooms two to ten years out for a group's contracted meeting. A contract attrition clause is an insurance policy for the hotel, guaranteeing them revenue from the sleeping rooms and/or a penalty paid by an organization if it does not fulfill its sleeping room block. This penalty can be substantial!

Why does it matter if I stay at a hotel other than selected GSA official (contracted) hotels?

In order to get the convention center space we need, we must contract with a number of hotels (number varies by city) and sometimes specific hotels. To get the meeting space we need at the headquarters hotel, we often have to take a large block of sleeping rooms and guarantee that we will fill that block. If we do not fill the block we may have to give back some of the meeting space and/or pay an attrition penalty.

In 2002, GSA narrowly avoided a $251,000 penalty at one of our contracted hotels because attendees were not reserving rooms in the hotel. If GSA had had to pay the $251,000 penalty, GSA members, as well as Annual Meeting attendees, would have felt the impact of this penalty. We could have seen cuts in educational programs and member benefits, increased membership fees, staff cuts, and higher meeting registration fees. For instance, if that penalty were to be covered entirely by the Annual Meeting registration fees, professional attendees would have seen a $75 increase for the meeting in 2003, and students and others would also have seen an increase of some 25%–30%.

How does GSA choose the hotels it contracts with?

In some cities, there is only one possible headquarters hotel. In cities where there are multiple choices, we choose headquarters hotels based on a number of factors, including an adequate amount of meeting space, distance from the convention center, sleeping room rates, hotel and service quality, and the suitability of negotiated contract terms.

After the headquarters hotel is established, GSA Meetings staff works to secure a good mix of viable options for attendees. Sometimes, in the case of many smaller hotels, it may not be cost effective (in terms of staff time) to contract with a hotel that can only offer 10–50 sleeping rooms for GSA. Some hotels don't contract with groups at all; they rely entirely on transient (individual traveler) business. Some cities are simply overbuilt. GSA cannot contract with too many hotels, or we invite even more attrition penalties.

I found a cheaper rate on a Web site for one of GSA's contracted hotels.

Book it! But make the reservation in the name of the meeting attendee. Then send an e-mail to meetings@geosociety.org to let us know. Generally, there are very few of these rooms available at the lower price. Not all attendees can get this rate, and the hotel will not offer this rate to GSA in a contract.

Many of the larger hotel chains are providing a new "Guaranteed Best Rate" incentive on their own Web sites. This is a guarantee that you will not find a lower rate on another discount travel Web site such as Expedia, Travelocity, or Orbitz. This does not apply to sites such as Hotwire or Priceline, where you place a bid and the hotel is not known until after the bid is accepted, or on package deals that include airline or car rental.

All of our hotel contracts include a clause that states that the hotel cannot offer a lower rate to anyone else (excluding airlines, government, long-term corporate contracts, and the discount travel sites mentioned above) over the dates of the GSA Annual Meeting without offering it to our attendees. However, this occasionally happens if the room revenue manager of the hotel is not aware of our contract clause. Generally, these lower rates are offered less than 30 days out when the hotel begins to see that they are not going to sell out, although some hotels won't wait that long. Our hotel contracts also protect GSA with a clause that provides for GSA to get credit for any meeting attendee who stays in a contracted hotel, no matter how the reservation was made (Internet, directly

through the hotel, travel agent, etc.) or the rate paid. The reservation must be in the name of the meeting attendee in order for GSA to get credit. If it is in the name of an unregistered spouse, GSA does not get the credit.

I can't afford to stay at the more expensive hotels.

GSA contracts with several different hotels to accommodate a wide range of rates for our attendees. By making your reservations early, you can get into the less expensive hotels. Hotel reservations can be made as early as June 1, and the less expensive hotels are the first to sell out. If you wait until the deadline, it is unlikely that you will be able to get a room at the lower-priced properties.

Why can't you add more rooms at the less expensive hotels?

Most hotels will not contract more than a certain percentage of rooms to groups; many times hotels have other contracts (government, airline, or corporate) to fulfill. Also, because GSA gets a discount off of the group rate, hotels don't want to sell all of their rooms at the lower price.

In addition, GSA has to fulfill its room blocks in all of the contracted hotels. More rooms at the less expensive hotels jeopardizes fulfillment of block commitments at the other hotels. We then face attrition penalties at every hotel where commitments are not met.

I must have the government rate.

If the government per diem rate is lower than the GSA contracted rate, you can still stay in GSA contracted hotels. You can call the hotel directly or book on their Web site, but please ensure the reservation is in the name of the meeting attendee. If possible, ask the reservation agent to note that you are attending the GSA Annual Meeting.

I have to use our company travel agent to book my hotel.

If your travel agent will not make your reservation via the GSA Housing Bureau, ensure that the reservation is made in the name of the meeting attendee.

What determines whether the meeting is held in October or in November?

October is prime convention season, when rates are the highest and when space is in highest demand. The groups that can offer a city the highest economic impact and that can book many years out are the most valued. The GSA Annual Meeting is very "meeting-space intensive": in most cities, we take over the entire convention center and there is nothing left to be sold to other groups. Unfortunately, because attendees often book their sleeping rooms on the Internet or outside of the GSA contracted hotels, it is becoming more difficult to demonstrate how valuable the GSA meeting is to various cities. This can affect the dates and space we are able to reserve. Sometimes, we can get a significant reduction in convention center rental by holding the meeting in early November.

Why can't the GSA Annual Meeting be held in cities like Raleigh, North Carolina?

The GSA Annual Meeting requires a large amount of meeting space at both the convention center and headquarters hotels. Many of the less expensive cities are not large enough to hold the GSA Annual Meeting. As convention centers and headquarters hotels are being expanded and more flights offered in these smaller cities, they will be considered for future Annual Meetings. Portland, Oregon, is one of the cities that expanded its convention center and, assuming we can negotiate suitable contracts, it will be the site of the 2009 Annual Meeting.

Where do we go next?

In a survey conducted in 2002, past Annual Meeting attendees were asked in what cities they would likely attend a GSA Annual Meeting. The most popular cities (in order) were: Denver, Seattle, Portland (Oregon), Salt Lake City, San Francisco, and Boston. Three of these six cities are quite expensive, not only in hotel prices, but also convention center rental, labor, and food. They are some of the most popular locations for conventions, and their prices reflect this. We must hold meetings where attendees want to go, but at the same time in cities where costs can be controlled. I hope you will see from the list of future Annual Meeting sites below that GSA is striving hard to meet all needs.

Future GSA Annual Meetings

2005	Salt Lake City (October 16–19)
2006	Philadelphia (October 22–25)
2007	Denver (October 28–31)
2008*	Chicago (October 26–29)
2009	Portland, Ore. (tentative; October 18–21)
2010	Denver (October 31–November 3)
2011	Minneapolis (tentative; October 9–12)

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

THE GEOLOGICAL SOCIETY OF AMERICA

NORTHEASTERN

40th Annual Meeting
Northeastern Section, GSA
Saratoga Springs, New York

March 14–16, 2005

The 2005 meeting of the Northeastern Section of the Geological Society of America will be hosted by the Geology Departments of Union College, Schenectady, New York, and Skidmore College, Saratoga Springs, New York. The meeting will be at the Prime Hotel and Conference Center, located on the edge of downtown Saratoga Springs in beautiful upstate New York. Downtown Saratoga Springs starts at the hotel door and has a wide array of restaurants, pubs, and shops within easy walking distance.

CALL FOR PAPERS

Abstract deadline: December 14, 2004

Papers are invited for theme and general discipline sessions in both oral and poster format. Volunteered papers will be considered for any general discipline session as listed on the GSA Abstracts Form. Authors interested in submitting papers for symposia should contact the appropriate symposium conveners before submitting. An individual may be presenter for only one volunteered paper (excepting symposia papers), but may be co-author on any number of abstracts. Those invited for symposia may present additional papers. For further information, please contact Technical Program Chair John Garver, garverj@union.edu. Abstracts of papers must be submitted using the electronic submissions form at www.geosociety.org. If you have questions regarding abstract submission, please contact Nancy Carlson, ncarlson@geosociety.org.

REGISTRATION

Preregistration deadline: February 7, 2005
Cancellation deadline: February 14, 2005

GSA Headquarters will handle registration, and details will be published in the December issue of *GSA Today*. Registration will be available online at www.geosociety.org. On-site registration will be available at the Prime Hotel and Conference Center during the meeting.

TECHNICAL PROGRAM

The following symposia and theme sessions are planned for the Saratoga Springs 2005 meeting. Anyone interested in proposing additional symposia or theme sessions should contact Technical Program Chair John I. Garver, garverj@union.edu or Kyle Nichols, knichols@skidmore.edu. The final deadline for new session proposals is September 15. Presentations for Symposia are generally by invitation only, so if you are interested in participating, please contact session coordinators.

SYMPOSIA

1. **Stromatolites, Biomats, and their Influence on Sedimentation.** Mark McMenamin, Mount Holyoke College, mmcmenam@MtHolyoke.edu, (413) 538-2280; Bosiljka Glumac, Smith College, bglumac@science.smith.edu, (413) 585-3680.
2. **Geological Contributions to the Understanding of Late Holocene Human Populations in the Northeast.** Stephen Pollock, University of Maine, pollock@usm.maine.edu, (207) 780-5353.
3. **Geochemistry and Transport of Particles and Particle-Associated Contaminants in Rivers and Estuaries.** T.A. Abrajano, Jr., Rensselaer Polytechnic Institute, abrajt@rpi.edu, (518) 276-6036; Richard Bopp, Rensselaer Polytechnic Institute, boppr@rpi.edu, (518) 276-3075; Damon Chaky, LDEO, Columbia University, chakyd@ldeo.columbia.edu, (845) 365-8657.
4. **History of Geology of Northeastern North America.** Gerald M. Friedman, Northeastern Science Foundation/ Rensselaer Center of Applied Geology, gmfriedman@juno.com, (518) 273-3247.

THEME SESSIONS

1. **Records of past monsoon dynamics and links between high and low latitude climatic processes.** Heather Stoll, Williams College, hstoll@williams.edu, (413) 597-4541.
2. **Ecohydrology: Interdisciplinary Ecosystem Research.** David A. Franzi, SUNY Plattsburgh, david.franzi@plattsburgh.edu, (518) 564-4033; Ken Adams, SUNY Plattsburgh, (518) 564-4033.
3. **Economic Minerals and Rocks of Northeastern North America.** Robert J. Altamura, P.G. Geo-Environmental Consulting, State College, Pennsylvania, altamura@geosc.psu.edu, (814) 234-5011; William M. Kelly, New York State Museum, wkelly@mail.nysed.gov, (518) 474-5816.
4. **Thermal History and Metamorphism of the Adirondacks in the Context of the Broader Grenville Orogenic Cycle.** Marion "Pat" Bickford, Syracuse University, mebickfo@syr.edu, (315) 443-9290; James McClelland, Colgate University.
5. **Enhancing Professional Development for K–12 Teachers (Posters Only).** Michael J. Passow, White Plains, New York, Middle School and Lamont-Doherty Earth Observatory of Columbia University, michael@earth2class.org, (201) 871-0846.
6. **K–12 Education: Data collection and Analysis from the Field (Oral Only).** Edward L. (Ted) Shuster, Rensselaer Polytechnic Institute, shuste@rpi.edu, (518) 276-6494; Renee Frachioni, Averill Park High School, Averill Park, New York, robidr@alum.rpi.edu, (518) 674-7000.
7. **Teaching Sedimentology, Stratigraphy, and Paleontology: Using Local Geology and**

Modern Analogs. Bosiljka Glumac, Smith College, bglumac@science.smith.edu, (413) 585-3680.

8. **Sequence Stratigraphic Approaches to Paleobiologic and Sedimentologic Investigations of Lower Paleozoic Strata of the Northern Appalachians.** Alex Bartholomew, University of Cincinnati, alexbartholomew_geo@hotmail.com, (513) 556-3732; Sean Cornell, Juniata College, cornels@email.uc.edu, (513) 556-3732.
9. **Thermochronologic Studies Aimed at Understanding Orogenic Cooling.** Mary Roden-Tice, SUNY Plattsburgh, mary.rodentice@plattsburgh.edu, (518) 564-4032; John I. Garver, Union College, garverj@union.edu, (518) 388-6770; Robert P. Wintsch, University of Indiana, Bloomington, wintsch@indiana.edu, (812) 855-4018.
10. **New Models of Appalachian Tectonics Inspired by Geochronology: 3rd Annual NETectonics Session.** Paul Karabinos, Williams College, Paul.M.Karabinos@williams.edu, (413) 597-2079; David P. West Jr., Middlebury College, dwest@middlebury.edu, (802) 443-3476; Joe Pyle, Rensselaer Polytechnic Institute, pylej@rpi.edu, (518) 276-4899.
11. **Aspects of Taconic Deformation.** Jean Crespi, University of Connecticut, jean.crespi@uconn.edu, (860) 486-0601; Art Goldstein, Colgate University, agoldstein@mail.colgate.edu, (315) 228-7203.
12. **Late Ordovician Taconian Orogenesis and Sedimentological Effects: Developing Tectonic, Sedimentological, and Paleontological Perspectives.** Gordon C. Baird, SUNY Fredonia, baird@fredonia.edu, (716) 673-3840; Charles E. Mitchell, SUNY Buffalo, cem@geology.buffalo.edu, (716) 645-6800, ext. 3991.
13. **Ancient Fault- and Fracture-Related Hydrothermal Fluid Flow in Eastern North America: Processes and Products.** Langhorne "Taury" Smith, New York State Museum, lsmith@mail.nysed.gov, (518) 473-6262.
14. **Applications of Remote Sensing, GIS, and Geodesy.** Joan M. Ramage, Lehigh University, ramage@lehigh.edu, (610) 758-3660; Joanna Reuter, University of Vermont, Joanna.Reuter@uvm.edu, (802) 656-4411.
15. **New Developments in the Late Quaternary History of the Northeastern United States and Adjacent Canada.** John A. Rayburn and Peter L.K. Knuepfer, Binghamton University, jrayburn@binghamton.edu, knuepfr@binghamton.edu, (607) 777-2264 or (607) 777-2389.
16. **Isotope Geochemistry in Environmental and Paleoenvironmental Studies.** Andrea Lini, University of Vermont, alini@zoo.uvm.edu, (802) 656-0245; Robert H. Michener, Boston University, michener@bio.bu.edu, (617) 353-6980.
17. **Lakes and Environmental Change.** John G. Arnason, University at Albany, arnason@atmos.albany.edu, (518) 442-4474; Donald T. Rodbell, Union College, rodbelld@union.edu, (518) 388-6034.
18. **Rates and Dates of Geomorphic Processes in the Appalachians.** Paul Bierman, University of Vermont, Paul.Bierman@uvm.edu, (802) 656-4411.
19. **Springs in the Water Cycle: Supply, Water-rock Interaction, and History.** Don Siegel, Syracuse University, disiegel@syr.edu, (315) 443-3607.
20. **Careers in Professional Geology: Highlights for Students and Academics.** Skip Delclos, Lansing Hisert Group, Albany, New York, sdelclos@lansinghisert.com, (518) 899-5243 ex. 101.
21. **Bentonites in the Geologic Record.** George Shaw, Union College, shawg@union.edu, (518) 388-3770; Charles Ver Straeten, New York State Museum, CVERSTRA@mail.nysed.gov, (518) 486-2004.

FIELD TRIPS

Field trip details will be available in the December issue of *GSA Today* and at www.geosociety.org. Anyone interested in proposing additional field trips should contact Field Trip Coordinator Don T. Rodbell, rodbelld@union.edu. For additional field trip information, contact Don Rodbell or the individual field trip leaders.

1. **Stratigraphy of the Middle and Upper Ordovician Black River and Trenton Groups in the Mohawk and Black River Valleys.** Sean Cornell, Juniata College, cornels@email.uc.edu, (513) 556-3732.
2. **Devonian Stratigraphy of Eastern New York State.** Alex Bartholomew, University of Cincinnati, alexbartholomew_geo@hotmail.com, (513) 556-3732; Charles A. Ver Straeten Center for Stratigraphy and Paleontology, New York State Museum, cverstra@mail.nysed.gov; James R. Ebert, SUNY College at Oneonta, Ebertjr@oneonta.edu, (607) 436-3065; George H. Shaw, Union College, shawg@union.edu, (518) 388-6770.
3. **Geology and History of Howe's Cavern (for Earth Science Teachers).** George Shaw, Union College, shawg@union.edu, (518) 388-3770; Matt Montario, University at Albany, State University of New York, mjmontario@hotmail.com.
4. **Two Devonian Reefs: Sponges versus Corals.** Robert Finks, Union College, finksr@union.edu, (518) 943-9746.
5. **Stratigraphy of Thatcher Park, New York.** Edward Stander, SUNY Cobleskill, standeej@cobleskill.edu, (518) 478-9446.
6. **Saline Springs, Microbial Reefs, and Basalt Pillows: Three Natural Wonders of Saratoga (for K–12 teachers).** Richard H. Lindemann and Kimberly A. Marsella, Skidmore College, kmarsell@skidmore.edu, (518) 580-5195.
7. **Stromatolites of the Petrified Gardens.** Gerald M. Friedman, Northeastern Science Foundation/Rensselaer Center of Applied Geology, gmfriedman@juno.com, (518) 273-3247.

SHORT COURSES

Short course details will be available in the December issue of *GSA Today* and at www.geosociety.org. Anyone interested in proposing additional short courses should contact Short Course Coordinator Kurt Hollocher, hollochk@union.edu.

1. **U-Pb Geochronology: Methodology and Data Interpretation.** Brent V. Miller, Research Scientist, Radiogenic Isotope Geochemistry, Texas A&M University, bvmiller@geo.tamu.edu, (979) 458-3671; Scott Samson, Syracuse University, sdsamson@syr.edu, (315) 443-2672. This short course will discuss aspects of U-Pb geochro-

nology from sample selection to data acquisition and interpretation. This course is aimed at field geologists and other non-specialists who regularly use geochronology in their research, but who wish to understand better the details of methodologies and critical evaluation of geochronologic data.

ACCOMMODATIONS

A large block of rooms at special rates has been reserved at the Prime Hotel and Conference Center. Room cost is as low as any Northeastern Section meeting in the U.S. in recent memory. Available are regular hotel rooms and larger rooms that may be suitable for groups (www.union.edu/PUBLIC/GEODEPT/hollocher/negsa2005/room_options.htm). Reservations can be made direct by calling (518) 584-4000 or 888-999-4711. You MUST identify yourself as attending the GSA meeting to get the special room rates.

EXHIBITS

Exhibits will be located in the Prime Hotel and Conference Center. Exhibit rates will be $100 for nonprofit organizations and $200 for others. Booth space will include 10' by 10' space with draped framing, one table, and electrical access. For further information, reserving booth space, or making other arrangements, contact Exhibits Coordinator George Shaw, shawg@union.edu.

SPECIAL EVENTS

Dredging PCBs from the Hudson: Progress and Prospects. This special public forum will be held Monday, March 14, 7–9 p.m., in the Ballroom of the Prime Hotel and Conference Center. Speakers will include Richard Bopp, Department of Earth and Environmental Science at RPI, John G. Haggard, Engineering Project Manager at General Electric, and David H. King, Director of the Albany EPA Field Office. The forum will be moderated by Jean Neubeck of Alpha Geoscience.

The famous **NEGSA Map Blast** will be held as usual. It will be located in the Prime Hotel and Conference Center and will feature a cash bar.

Society and committee business meetings, breakfasts, and lunches may be scheduled by contacting Business Meeting Coordinator Kurt Hollocher, hollochk@union.edu.

GUEST ACTIVITIES

Saratoga Springs has a wide array of museums, parks, and other sites of historic and cultural interest. Information on the spouse and guest programs will available in the December issue of *GSA Today*.

WORKSHOPS

Roy J. Shlemon Mentor Program in Applied Geoscience. *Sponsored by GSA Foundation*. Mon., March 14, and Tues., March 15, 11:30 a.m.–1 p.m.; location available at GSA's registration desk. Karlon Blythe, kblythe@geosociety.org. This interactive and informative program for undergraduate and graduate students, led by professional geoscientists, will cover real-life issues including professional opportunities and challenges that await students after graduation. Plan to attend both free luncheons to hear different presenters each day. Students will receive in their registration packet FREE LUNCH tickets to attend both Shlemon Programs. However, space is limited. First come, first served.

The John Mann Mentors in Applied Hydrogeology Program. *Sponsored by GSA Foundation*. Tues., March 15, 5–6:30 p.m. Meeting location information available at GSA's registration desk. Karlon Blythe, kblythe@geosociety.org. This early evening event presents mentoring opportunities for undergraduate and graduate students and recent graduates with declared interest in hydrogeology as a career to interact and network with practicing hydrogeology professionals. This program is a focused, small-scale event that features FREE FOOD for participants. Participant eligibility is limited to those students who have declared their career interest to be hydrology or hydrogeology on their GSA membership applications and who have registered online for this meeting. An e-mail invitation will then be sent to those qualified students. Keep in mind that only a quick response to the invitation will secure you a seat, as attendance at this Mann Mentor event is limited!

SPONSORSHIP

Corporate sponsors for this meeting will have their names published in the final meeting announcement and in the meeting program. Interested parties may contact the Meeting Sponsorship Coordinator Kurt Hollocher, hollochk@union.edu.

STUDENT TRAVEL GRANTS

Travel grants are available from the Northeastern Section of GSA in cooperation with the GSA Foundation. Grants are available to both undergraduate and graduate students who are currently enrolled GSA members and who are presenting oral or poster papers at this meeting. To apply, contact Stephen Pollock, pollock@usm.maine.edu, Secretary-Treasurer, GSA Northeastern Section.

ACCESSIBILITY

GSA is committed to ensuring full participation for conference attendees with disabilities at all events at the 2005 meeting. Every attempt is made for full compliance with the Americans with Disability Act. You may indicate special requirements on your registration form, and you should inform the local organizing committee of these requirements at least one month prior to the meeting. Specially accessible rooms are available and can be reserved when making your reservation.

DETAILED INFORMATION

Detailed information will be published in the December issue of *GSA Today*. Additional information on times, location, directions, accommodations, and contact information is available at www.geosociety.org, our host's Web site, www.union.edu/PUBLIC/GEODEPT/hollocher/negsa2005/, or by contacting Kurt Hollocher, hollochk@union.edu.

THE GEOLOGICAL SOCIETY OF AMERICA

SOUTHEASTERN

54th Annual Meeting
Southeastern Section, GSA
Biloxi, Mississippi

March 17–18, 2005

The 2005 meeting of the Southeastern Section of the Geological Society of America will be held on the Mississippi Gulf Coast, a location with a perhaps unexpected concentration of earth science activity. Stennis Space Center, NASA's primary location for rocket propulsion testing, headquarters for their Earth Science Applications Directorate, and the site of the largest naval oceanographic research center in the world, is home to more than 30 resident agencies and numerous technology-based organizations. NOAA's National Coastal Data Development Center, EPA's Gulf of Mexico Project, and other federal agencies are joining with the University of Southern Mississippi to host the 2005 meeting.

Biloxi is situated on a Sangamon beach-dune ridge complex that extends from Bay St. Louis to Belle Fontaine Point east of Ocean Springs. The complex makes up the Gulfport Formation, and consists mostly of clean quartz sand that was deposited during a transgression over older Pleistocene sediments. Subsequent lowering of sea level segmented the complex by stream incision at what are now St. Louis Bay and Biloxi Bay, and the most recent rise of sea level led to flooding of areas on the mainland side of the complex.

The barrier islands adjacent to the coast, the Mississippi River, classic Coastal Plain localities, and the southernmost exposures of the Appalachians in Alabama provide exciting field trip opportunities.

ACCOMMODATIONS

Hotel registration deadline: February 13, 2005

A block of rooms in the Bayview Hotel at the Grand Casino Resort has been reserved at $115 per night for two people, with a $10 per night charge for each additional person. The reservation number is (800) 354-2450. The Grand Casino Resort includes nine restaurants, a variety of entertainment, water sports, golf, and child care facilities.

TRANSPORTATION

Biloxi is located south of Interstate 10 on the eastern Mississippi Gulf Coast, approximately 60 miles west of Mobile and 90 miles east of New Orleans. The Gulfport-Biloxi Regional Airport is served by AirTran, ASA Delta, Continental, Northwest, and Southeast airlines. Shuttle service is available to the hotel.

CALL FOR PAPERS

Abstract deadline: December 14, 2004

Papers are invited from students and professionals for oral and poster general discipline sessions, theme sessions, and symposia. Abstracts must be submitted online at www.geosociety.org. An abstract submission fee of $10 will be charged. Only one volunteered paper may be presented by an individual; however, a person may be a co-author on other papers. Those invited for symposia may present an additional paper.

REGISTRATION

Preregistration deadline: February 14, 2005
Cancellation deadline: February 21, 2005

GSA Headquarters will handle meeting registration, and details will be published in the December issue of *GSA Today*. Registration will also be available online at www.geosociety.org. On-site registration will be available at the Grand Casino and Convention Center during the meeting.

SYMPOSIA AND THEME SESSIONS

Symposia, theme sessions, field trips, and special events scheduled as of July 1 are listed in this announcement. Additional events may be accommodated. Please check the Web site for updated information.

SYMPOSIA

1. **Exceptional Biotas and Fossil Preservation in the Southeast.** *Sponsored by the Southeastern Section, Paleontological Society*. Michael A. Gibson, The University of Tennessee—Martin, mgibson@utm.edu; David Schwimmer, Columbus State University, schwimmer_david@colstate.edu.
2. **The Use of Geospatial Data in Developing Public Policy.** *Sponsored by the Southeastern Section, GSA Geology and Public Policy Committee.* John Kiefer, Kentucky Geological Survey, kiefer@kgs.mm.uky.edu.

THEME SESSIONS

1. **Coastal Processes: Naturally and Artificially Impacted.** Ping Wang, University of South Florida, pwang@cas.usf.edu; Jim Flocks, USGS Center for Coastal and Watershed Studies, jflocks@usgs.gov.
2. **Coastal System Databases.** Russell Beard, NOAA National Coastal Data Development Center, Russ.Beard@noaa.gov; Chris Jenkins, University of Colorado, chris.jenkins@colorado.edu.
3. **Digital Geologic Maps.** Michael W. Higgins, The Geologic Mapping Institute, mhiggins@mindspring.com; Ralph F. Crawford, The Geologic Mapping Institute, Crawford@sprintmail.com.
4. **Exotic Terranes in the Southern Appalachians: Evidence from Igneous, Sedimentary, and Metamorphic Rocks.** Paul A. Mueller, University of Florida, mueller@geology.ufl.edu; William A. Thomas,

University of Kentucky, geowat@uky.edu; Allen J. Dennis, University of South Carolina—Aiken, dennis@sc.edu.

5. **K–16 Earth Science Education: Teaching Geology in a Shifting Socio-environmental Environment.** *Sponsored by the Southeastern Section, National Association of Geoscience Teachers.* Douglas W. Haywick, University of South Alabama, dhaywick@jaguar1.usouthal.edu.
6. **Linking Paleoenvironments of Coasts with their Watersheds, Past and Present.** Charlotte Brunner, University of Southern Mississippi, Charlotte.Brunner@usm.edu.
7. **Processes Affecting Shoreline Erosion, Wetland Loss, and Coastal Evolution in the Southeastern U.S.** Shea Penland, University of New Orleans, spenland@uno.edu; Mark Kulp, University of New Orleans, mkulp@uno.edu.
8. **Tropical Cyclone Impacts on Coastal Zones.** Gregory W. Stone, Louisiana State University, gagreg@lsu.edu.
9. **Sea-level Changes and Coastal Evolution: Holocene and Modern.** Mike Blum, Louisiana State University, mike@geol.lsu.edu.

FIELD TRIPS

Field trip #1 will be an afternoon trip during the meeting. All other currently scheduled trips are postmeeting.

1. **On the Beach—Geology and Ecology of a Barrier Island System.** *Sponsored by the Southeastern Section, National Association of Geology Teachers.* Douglas W. Haywick, University of South Alabama, dhaywick@jaguar1.usouthal.edu.
2. **Classic Eocene and Oligocene Marine Localities in Central Mississippi.** *Sponsored by the Southeastern Section, Paleontological Society.* David T. Dockery III, Mississippi Office of Geology, David_Dockery@deq.state.ms.us.
3. **Engineering Geology and Geomorphology of the Natchez, Mississippi, Area and Geomorphic Influences of the Loess Deposits and Mississippi River Alluvial Valley on the Civil War Battle/Siege of Vicksburg, Mississippi.** David M. Patrick, University of Southern Mississippi, David.Patrick@usm.edu; Danny W. Harrelson, danny.w.harrelson@erdc.usace.army.mil; Robert J. Larson, U.S. Army Research and Development Center, robert.j.larson@erdc.usace.army.mil; and William M. Myers, U.S. Army Engineer Research and Development Center, william.m.myers@erdc.usace.army.mil.
4. **Fluctuating Sea Levels, Marine Highstands and Lowstands, Ice Age Droughts, and Coastal Barrier Evolution: A Quick Look at Pliocene and Quaternary Formations and Landforms along the Mississippi-Alabama Shore.** Ervin Otvos, University of Southern Mississippi, Ervin.Otvos@usm.edu.
5. **Geology of the Jacksons Gap Group, Brevard Zone of Alabama, and its Significance for Southern Appalachian Tectonic Evolution.** Mark G. Steltenpohl, Auburn University, steltmg@auburn.edu; Wes Sterling, Auburn University, sterljw@auburn.edu; Robert B. Cook, Auburn University, cookrob@auburn.edu.
6. **Transverse Zones, Lateral Ramps, and Mushwads in the Appalachian Thrust Belt in Alabama.** William A. Thomas, University of Kentucky, geowat@uky.edu.

SPECIAL ACTIVITIES

1. **On the Beach: Geology and Ecology of a Barrier Island.** *Sponsored by the Southeastern Section, National Association of Geology Teachers.* This informal field trip (#1 above) to a barrier island will leave in the late afternoon on Thursday and return after a crawfish boil on the beach in the evening. All K–12 teachers, geology students, professionals, and guests are invited to participate.
2. **Geology Day at Grand Bear Golf Course.** Join your golfing friends for an informal golf tournament at Grand Casino's Grand Bear golf course, an 18-hole, Jack Nicklaus Signature golf course, on Wednesday, March 16.
3. **Ocean Springs Art Tour.** This guest activity will feature a tour of the Walter Anderson Museum of Art and Shearwater Pottery with time for shopping at the many galleries and antique shops in this historic town.
4. **Stennis City.** Personnel and exhibits from Stennis Space Center will be featured at the opening reception.
5. **Stennis Space Center Tour.** A bus tour of Stennis Space Center will be of interest to guests and other meeting participants. Restricted to U.S. citizens.

WORKSHOPS

Roy J. Shlemon Mentor Program in Applied Geoscience. *Sponsored by GSA Foundation.* Thursday, March 17, and Friday, March 18, from 11:30 a.m.–1 p.m.; location available at GSA's registration desk. Karlon Blythe, kblythe@geosociety.org. This interactive and informative program for undergraduate and graduate students, led by professional geoscientists, will cover real-life issues including professional opportunities and challenges that await students after graduation. Plan to attend both free luncheons to hear different presenters each day. Students will receive in their registration packet FREE LUNCH tickets to attend both Shlemon Programs. However, space is limited. First come, first served.

The John Mann Mentors in Applied Hydrogeology Program. *Sponsored by GSA Foundation.* Thursday, March 17, 5–6:30 p.m. Meeting location information available at GSA's registration desk. Karlon Blythe, kblythe@geosociety.org. This early evening event presents mentoring opportunities for undergraduate and graduate students and recent graduates with declared interest in hydrogeology as a career to interact and network with practicing hydrogeology professionals. This program is a focused, small-scale event that features FREE FOOD for participants. Participant eligibility is limited to those students who have declared their career interest to be hydrology or hydrogeology on their GSA membership applications and who have registered online for this meeting. An e-mail invitation will then be sent to those qualified students. Keep in mind that only a quick response to the invitation will secure you a seat, as attendance at this Mann Mentor event is limited!

EXHIBITOR INFORMATION

Exhibit space will be available in a centrally located exhibit hall, shared with poster sessions. For more information on exhibit rates and space reservations, contact Lin Pope, Lin.Pope@usm.edu.

STUDENT TRAVEL GRANTS

Travel grants are available from the Southeastern Section of GSA and the GSA Foundation to both undergraduate and graduate students who are presenting papers or poster sessions and are student members of GSA. Information and applications are available at http://core.ecu.edu/geology/neal/segsa/travel.html.

ACCOMMODATIONS FOR REGISTRANTS WITH SPECIAL NEEDS

The Southeastern Section of GSA is committed to making every event at the 2005 meeting accessible to all people interested in attending. If you have special requirements, please contact the local committee chair.

ADDITIONAL INFORMATION

For further information, please contact the local committee chair, Gail Russell, Gail.Russell@usm.edu.

Additional meeting information is available at the following sites.
www.geosociety.org/sectdiv/southe/05semtg.htm
www.usm.edu/geology/SEGSA/prelim.htm

The following sites contain information about the Mississippi Gulf Coast.
Stennis Space Center: www.ssc.nasa.gov/

Grand Casino Resort: www.caesars.com/GrandCasino/biloxi/

Mississippi Gulf Coast: www.gulfcoast.org/

ATTENTION STUDENTS!

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

Call for Geological Papers: 2005 GSA Section Meetings

Northeastern Section
March 14–16, 2005
Prime Hotel and Conference Center, Saratoga Springs, New York
Abstract Deadline: December 14, 2004
Information: Kurt Hollocher, Union College, Department of Geology, Olin Building, Nott Sreet, Schenectady, NY 12308-3107, (518) 388-6518, hollochk@union.edu

Southeastern Section
March 17–18, 2005
Grand Casino Biloxi, Biloxi, Mississippi
Abstract Deadline: December 14, 2004
Information: Gail Russell, University of Southern Mississippi, Department of Geology, Box 5044, Hattiesburg, MS 39406-2000, (601) 266-4077, Gail.Russell@usm.edu

South-Central Section
April 1–2, 2005
Trinity University, San Antonio, Texas
Abstract Deadline: December 17, 2004
Information: Diane Smith, Trinity University, Department of Geosciences, #45, One Trinity Place, San Antonio, TX 78212-4674, (210) 999-7656, dsmith@trinity.edu

Cordilleran Section
(*Joint meeting with American Association of Petroleum Geologists*)
April 29–May 1, 2005
Fairmont Hotel, San Jose, California
Abstract Deadline: February 1, 2005
Information: Jonathan Miller, San Jose State University, Department of Geology, 1 Washington Square, San Jose, CA 95192-0102, (408) 924-5015, jsmiller@email.sjsu.edu

North-Central Section
May 19–20, 2005
University of Minnesota, Minneapolis, Minnesota
Abstract Deadline: February 22, 2005
Information: Carrie Jennings Patterson, University of Minnesota, Minnesota Geological Survey, 2642 University Ave. W., St. Paul, MN 55114-1032, (612) 627-4780, ext. 220, carrie@umn.edu, or Barbara Lusardi, University of Minnesota, Minnesota Geological Survey, 2642 University Ave. W., St. Paul, MN 55114-1032, (612) 627-4780, ext. 212, lusar001@umn.edu

Rocky Mountain Section
May 23–25, 2005
Mesa State College, Grand Junction, Colorado
Abstract Deadline: February 22, 2005
Information: Rex Cole, Mesa State College, Department of Physical & Environmental Science, 1100 North Ave., Grand Junction, CO 81501-3122, (970) 248-1599, rcole@mesastate.edu

www.geosociety.org/sectdiv/sections.htm

COMMENTARY

Jailhouse Rock

***Robert M. Thorson**, University of Connecticut*

Most of us have heard of the Society for the Prevention of Cruelty to Animals. But has anyone ever heard of the Society for the Prevention of Cruelty to Rocks? That may be just what's needed in order to liberate Plymouth Rock from its ornate prison.

Contemporary pilgrims come from all over the world to see this memorial to our national beginnings. They come to see this glacier-dropped boulder that—legend has it—marks the spot where the first New Englanders stepped ashore in 1620. When they arrive, however, many are disappointed. This is partly because the boulder is dull gray in color and has the shape of a stepped-on potato. But the more important reason—at least the one identified by my unscientific opinion survey—is that the object of their pilgrimage lies in a pit, 10–20 feet below street level, a position that invites disrespect. Cigarette butts, bus ticket stubs, wads of chewing gum, and coins—most of them pennies—litter this low-down object.

Nearly 400 years ago, however, Plymouth Rock invited respect. To those who sailed in on the *Mayflower*, this sun-bleached granite boulder would have shone like a beacon on an otherwise low shore. To those who had just spent months on the storm-tossed Atlantic, it would have conveyed a genuine sense of hard-rock stability in an otherwise shifting world of rolling seas, swashing sand, and flooded marsh—something even more firm than the English soil they had left behind.

I imagine a boatload of Pilgrims, rowing and wading ashore. I imagine them touching, patting, and rubbing the rock, as if testing to make sure the North American continent was solid enough for their new home.

Eventually, they built homes, survived, gave thanks, and went on to create the oldest English colony in the Northeast. As it grew, other objects began to dot the shoreline, diminishing the singularity of the boulder. The shore above high tide became a commercial street for merchant ships. Storms called Nor'easters pounded the bank. Sea level crept slowly higher. Development encroached. The street was widened then raised. A new wharf was built over the rock in 1741, but the large boulder still stood in the way of progress. In 1774, a committee decided to save it for the future, something we can all be thankful for.

Heavy chains were threaded around the boulder. Oxen teams were called from nearby farms. A crowd gathered. Four-footed "tractors" strained to nudge the boulder out of its wet, sandy cradle. Instead of sliding forward, however, the boulder fell and was decapitated, its rounded top split away from its buried bottom along a preexisting fracture.

After considerable consternation, the top half was hauled to the town center, where it was installed as a monument to colonial success. Meanwhile, the bottom half was buried by progress. Over time, the top half of the boulder began to disappear. At first, chunks were quarried off for museum exhibits and souvenirs for civic leaders. Then it seemed as if everyone wanted a piece of the rock, which could be had simply by whacking its edge with a hammer.

After who-knows-how-many whacks, the village had no choice but to guard the monument behind iron bars. But the bars only slowed the rate of stone thievery. So, to ensure greater protection, the beaten-up half-boulder was loaded into a strong cart in 1834 and hauled to a more secure site fronting the Pilgrim Museum. Unfortunately, it slid off the cart and broke apart once again.

Imagine the consternation. Eventually, a decision was made to unite what the glacier had brought to Plymouth in one piece. Back at the wharf, its bottom half was re-exposed by peeling away the boardwalk above it. Meanwhile, the two remaining fragments (both smaller due to the taking of souvenirs) were hauled back to the original site. Then, in 1880, Plymouth Rock was reassembled, its pieces cemented back to the mother stone. Across the top was chiseled the date of 1620.

One irksome problem remained. The united icon of freedom still lay below street level in a pit resembling a bomb crater. The solution was to fence off the pit with another set of bars, then to build an ornate, open-air, stone building above the whole thing. I think this edifice looks abysmally bad, rather like an elegant mausoleum designed to exhibit the battered corpse of a stone potato.

Every Thanksgiving, I express gratitude for the good intentions of Plymouth's town fathers. After all, they did save the rock. But I am not thankful for what strikes me as cruel treatment: decapitation by chains; hammering and chiseling; careless transportation; lousy patch job; deep inscription. Worst of all was imprisoning the stone in a permanent state of lowliness.

Four centuries later, I want to reach out and touch Plymouth Rock. I want to close my eyes and feel with my fingers what the Pilgrims must have felt. But the modern-day keepers of the stone—the National Park Service—won't let us. Nor will they raise America's most famous boulder to the position of respect it deserves.

Until that day comes, I console myself by occasionally touching my own little piece of the rock, one that I didn't obtain by defacing this American shrine. You see, though the original Plymouth Rock is priceless as an artifact, as a material it's practically worthless, being a Plain Jane, ho-hum, Billy-Bob, knock-about fragment of the Dedham Granite (the technical name for the bedrock south of Boston).

In other words, my piece of the rock is the "little sister" of the famous boulder, a chip off the same parent block. To get it, all I had to do was pick up a pebble from the shore of Cape Cod Bay. I keep my piece of the rock up high, on the mantle above the fireplace. Each Thanksgiving, I take it down reverently and put it on the table, right between the turkey and the cranberry sauce. Then, before I give thanks for everything, I pray that its big sister be set free.

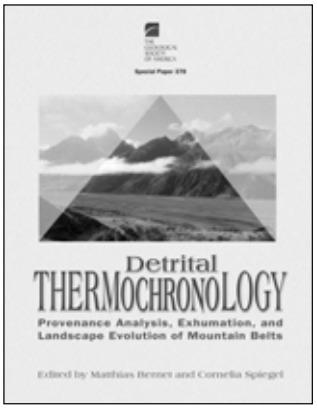
Robert M. Thorson's book Stone by Stone *recently won the Connecticut Book Award in the nonfiction category.*

This article first appeared as a commentary in The Hartford Courant.

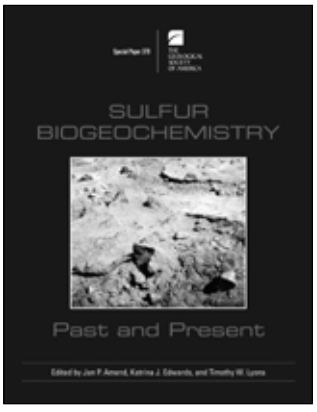
THE GEOLOGICAL SOCIETY OF AMERICA

New at the GSA Bookstore

Special Papers



Detrital thermochronology—Provenance analysis, exhumation, and landscape evolution of mountain belts
edited by Matthias Bernet and Cornelia Spiegel
SPE378, 126 p., ISBN 0-8137-2378-7
$55.00, **member price $44.00**
Detrital thermochronology is one of the fastest-growing disciplines in geosciences today because it provides valuable insights into the long-term evolution of mountain belts and the interplay of tectonics and climate in orogenic systems. The ability to determine cooling or crystallization ages of detrital apatite, zircon, or white mica from synorogenic sediments using a variety of techniques such as fission-track, Ar-Ar, or U-Pb dating enables us to determine potential sediment source areas, reconstruct the thermal history of an orogen, calculate exhumation rates, and detect changes in topography and drainage divides. The different dating techniques can easily be combined on the same samples or with other analytical methods to obtain the maximum amount of information. This book discusses some of the fundamental aspects of detrital thermochronology and presents applications in different orogenic settings that highlight the value of this current development.



Sulfur biogeochemistry—Past and present
edited by Jan P. Amend, Katrina J. Edwards, and Timothy W. Lyons
SPE379, 205 p., ISBN 0-8137-2379-5
$75.00, **member price $60.00**
This Special Paper presents recent advances in the biogeochemistry of sulfur, loosely grouped in four thematic areas. The first three chapters primarily address microbial contributions to sulfur biogeochemistry, including sulfate reduction and organic matter conversion in marine sediments, the energetics of microbially mediated sulfur oxidation and sulfur reduction reactions, and the abundance and diversity of eukaryotic communities in deep-sea sulfidic sites. The second section focuses on sulfide oxidation in the environment—terrestrial and marine, contaminated and pristine. The next three chapters explore the formation, distribution, recycling, and burial of various sulfur species in sedimentary systems, and papers in the final section are linked by the theme that sulfur records biogeochemical conditions in the ancient ocean.

Memoir

Proterozoic tectonic evolution of the Grenville orogen in North America
edited by Richard P. Tollo, Louise Corriveau, James McLelland, and Mervin J. Bartholomew
MWR197, 798 p. plus index,
ISBN 0-8137-1197-5
$195.00, **member price $156.00**
The geological evolution of the Grenville orogenic belt represents one of the most widespread episodes of crustal modification in Earth's history. The 39 papers in this volume offer a system-wide perspective on rocks and processes of the Mesoproterozoic Grenville orogen and Appalachian inliers and include many multidisciplinary studies presenting results from integrated petrologic, geochemical, and geochronologic investigations. The volume includes contributions concerning the Grenvillian geology of Canada, the United States, and Mexico, focusing on both the tectonic evolution of the orogen and on innovative approaches to deciphering the igneous, metamorphic, structural, and metallogenic history of Mesoproterozoic assembly and Neoproterozoic rifting. The timing and regional correlation of events and processes is emphasized in order to bridge knowledge gaps within the orogen and to better understand the geodynamic framework.

In Press

Gneiss domes in orogeny
edited by Donna L. Whitney, Christian Teyssier, and Christine S. Siddoway
SPE380, ISBN 0-8137-2380-9

Hydraulic tests of Miocene volcanic rocks at Yucca Mountain and Pahute Mesa and implications for groundwater flow in the Southwest Nevada Volcanic Field, Nevada and California
by Arthur L. Geldon
SPE381, ISBN 0-8137-2381-7

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ANNOUNCEMENTS

MEETINGS CALENDAR

2005

June 15–18	International Symposium on the Geodynamics of Eastern Mediterranean: Active Tectonics of the Aegean, Haliç, Istanbul, Turkey. **Information:** Tuncay Taymaz, Istanbul Technical University (ITU), Maslak-TR-34390, Istanbul Turkey, (+90 212) 285 62 45, fax: (+090-212) 533-6515 or (+090-212) 285-6201, taymaz@khas.edu.tr, www.earth.itu.edu.tr/.
July 6–9	ECROFI XVIII (European Current Research on Fluid Inclusions), Siena, Italy. **Information:** ecrofiXVIII@unisi.it, www.unisi.it/eventi/ECROFIXVIII. (*Early registration and abstract deadline: March 15, 2005.*)
August 21–26	17th Meeting of the International Association of Forensic Sciences: Justice through Science, Hong Kong. **Information:** info@iafs2005.com, www.iafs2005.com.
September 11–16	International Association of Geochemistry and Cosmochemistry: 6th International Symposium on Applied Isotope Geochemistry (AIG-6), Prague, Czech Republic. **Information:** www.aig6.cz, e-mail aig6@natur.cuni.cz.
September 12–14	Pedometrics 2005 Frontiers in Pedometrics, Naples, Florida, USA. **Information:** http://conference.ifas.ufl.edu/pedometrics.

Visit www.geosociety.org/calendar/ for a complete list of upcoming geoscience meetings.

ABOUT PEOPLE

$200,000 Vetlesen Prize Awarded for Achievement in Climate Sciences Research

Columbia University's Lamont-Doherty Earth Observatory and the G. Unger Vetlesen Foundation awarded the 2004 Vetlesen Prize, considered among the most prestigious of earth sciences awards, to Professors Richard Peltier and **Sir Nicholas Shackleton,** a GSA member since 1979. The prize carries a cash value of $200,000 to be split between the honorees. Shackleton was awarded the prize for his far-reaching contributions to our understanding of the history of the Earth's climate system, playing a leadership role in a major revolution in the geologic sciences. Shackleton, of the Godwin Institute for Quaternary Research at the University of Cambridge, is a leader in elucidating the connection between climate and geologic processes through a remarkable ability to collect and interpret data from ocean sediments. For more information on the Vetlesen Prize, visit www.ldeo.columbia.edu/vetlesen/.

2004 Flight of Discovery Includes GSA Member

The 2004 Flight of Discovery recently concluded safely after a 14-day, 6000-mile, bicentennial journey that retraced the route of the 1804–1806 Lewis & Clark Corps of Discovery. Among the 30 volunteer scientists, pilots, and crew was GSA member **Phyllis Steckel**, who participated as a flight geologist. Steckel's personal interest included a regional reconnaissance of the Upper Missouri River Basin for evidence of paleo-seismic features such as sand blows, sand boils, and liquefaction. The recorded earthquake history of the region is sparse, although several moderate earthquakes (in the 4.5 to 5.5 range) have occurred over the past hundred years or so. Steckel was able to contact several local residents who have felt earthquakes and identify potential sources of recorded Native American oral and written histories that may include references to past earthquakes. Results of her study are planned to be presented in an upcoming GSA meeting. More information about Flight of Discovery is at www.flightofdiscovery.com.

Your Support Needed for Forming GSA Geomedicine Division

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

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

To form the Geomedicine Division, we need the support of 100 GSA members and approval by GSA Council. To indicate your support, please write

to geomed@geosociety.org. Petitions also will be available at the GSA Annual Meeting in Denver in November; please consult the meeting program for time and location of our organizational meeting. You may belong to multiple GSA divisions, and your participation may be active or passive.

Call for Entries: 2006 Rolex Awards

Individuals of any age, nationality, or background are invited to apply for the Rolex Awards for Enterprise, a philanthropic program created in 1976 to support groundbreaking projects in science and medicine; technology and innovation; exploration and discovery; and the environment and cultural heritage. All projects must improve the human condition and demonstrate the candidates' unfailing spirit of enterprise. Five winners will each receive $100,000. Application deadlines: Asia, the Pacific, and North, South, and Central America—May 31, 2005; Europe, the Middle East, and Africa: September 30, 2005. For complete information, see www.rolexawards.com.

ICDD Announces Crystallography Scholarship Awards

To encourage promising graduate students to pursue crystallography oriented research, the International Centre for Diffraction Data (ICDD) has established the Ludo Frevel Crystallography Scholarship Fund. Multiple recipients are selected on a competitive basis, each receiving an award of $2,250. For complete information on applicant qualifications and submission requirements, visit www.icdd.com/resources/awards/frevel.htm. Applications must be received by the ICDD by November 1, 2004.

Ads (or cancellations) must reach the GSA Advertising office one month prior. Contact Advertising Department, (303) 357-1053, 1-800-472-1988, ext. 1053, fax 303-357-1070, acrawford@geosociety.org. Please include address, phone number, and e-mail address with all correspondence.

Classification	Per Line for 1st month	Per line each addt'l month (same ad)
Situations Wanted	$2.25	$1.90
Positions Open	$7.00	$6.00
Consultants	$7.00	$6.00
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first 25 lines	$0.00	$2.85
additional lines	$1.85	$2.85
Web Only Ads	$7.00	$6.00
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Agencies and organizations may submit purchase order or payment with copy. Individuals must send prepayment with copy. To estimate cost, count 54 characters per line, including all punctuation and blank spaces. Actual cost may differ if you use capitals, centered copy, or special characters.

Positions Open

GEOPHYSICS: LITHOSPHERIC DEFORMATION
UNIVERSITY OF CALIFORNIA AT SANTA BARBARA

The Department of Geological Sciences at the University of California at Santa Barbara seeks a broadly educated geophysicist who conducts creative research in quantitative analysis of deformation processes within the lithosphere. The successful applicant should complement departmental strengths in tectonics, seismology, structural geology, and surface processes. This tenure-track appointment will be as an Assistant Professor to begin July 1, 2005. The appointee is expected to develop a vigorous, externally funded research program (for example, by participation in Earthscope) and will teach both undergraduate and graduate courses in geophysics and tectonics.

A Ph. D. is required at the time of appointment. Review of applications will begin November 1, 2004. Applicants should submit a letter of application, curriculum vita, and description of teaching and research objectives and accomplishments. Applicants should request that three referees send letters of evaluation directly to the search committee by November 1. Applicants should also provide the names, email addresses and contact information of those referees. All materials should be sent to: Doug Burbank, Search Committee Chair, Department of Geological Sciences, University of California, Santa Barbara, CA 93106-9630.

UCSB is an Equal Opportunity/Affirmative Action employer. The department is especially interested in candidates who can contribute to the diversity and excellence of the academic community through research, teaching and service.

ASSISTANT PROFESSOR, TENURE TRACK FACULTY
GEOLOGY POSITION, CALIFORNIA STATE
POLYTECHNIC UNIVERSITY, POMONA

The Geological Sciences Dept. invites applications for an Assistant Professor level tenure-track appointment beginning September 2005. Applicants should be field-based generalists with expertise in Sedimentary Geology/ Stratigraphy. All applicants must have a doctorate in Geology at the time of appointment. Applicants must have a strong commitment to a polytechnic, hands-on approach to educating undergraduates for careers in the geosciences. Applicants must be versatile, dynamic, enthusiastic instructors able to teach a variety of undergraduate gen. ed. classes, notable examples include: Earth Science Education, Natural Disasters, Physical Geology. In addition to Sedimentary Geology / Stratigraphy, the successful applicant must be able to teach one or more upper division core courses: Engineering Geology, Field Methods, GIS / Computer Applications, Applied Hydrogeology. Candidates must have the ability to work with a diverse student body and are expected to develop a research program involving undergraduates. Collaborative, interdisciplinary research with other faculty is encouraged. Additional responsibilities include: student advising, mentoring, university service activities. Applicants must submit a letter of interest, resume, statement of teaching and research interests, names of three current references (within the last two years), unofficial transcripts of doctoral work and a completed signed application form (supplied by the Department). After initial screening three written references (electronic OK) are required. A campus interview, three formal signed letters of reference and official confirmation (transcripts) of degree are required of all finalists. Initial screening: December 3, 2004 position open until filled or terminated. Mail requests and materials to: Dr. John A. Klasik, Chair, Geological Sciences Dept., Cal Poly Pomona, Pomona, Calif. 91768. Email requests to: jaklasik@csupomona.edu. EO/AA employer.

SOUTHWEST MISSOURI STATE UNIVERSITY
ASSISTANT PROFESSOR IN GEOLOGY

The Department of Geography, Geology and Planning invite applications for a tenure track Assistant Professor in Geology with an emphasis in Environmental Geology in Karst Terrains. Appointment may begin as early as January 2005 or as late as August 2005. Ph.D. in Geology or closely related field required at time of appointment. A commitment to teaching, research, and service is essential. Evidence of teaching effectiveness would be advantageous together with evidence of a productive research agenda.

The Department grants undergraduate degrees in geology, geography, cartographic sciences, planning, and earth science education and an M.S. in geospatial science. It is essential that the successful candidate be skilled in modern geospatial technologies as they apply to geologic mapping and environmental interpretation in karst terrains. Additional expertise in the area of land surveying would also be beneficial. Teaching responsibilities will include upper-division undergraduate courses in speleology and/or geologic mapping, a graduate-level course in the application of geospatial science to environmental geologic problems, and one or more sections per year of our General Education course in Environmental Geology. The successful candidate must be able to support our master's program in geospatial science by directing thesis projects involving the application of geospatial technologies to the solution of geologic problems in areas of karst terrain.

Applicants should submit a letter of interest and current curriculum vitae and arrange for three reference letters and copies of all academic transcripts to be submitted to Search Committee, C/O Department of Geography, Geology and Planning, Southwest Missouri State University, 901 South National, Springfield, MO 65804. The evaluation of applications will begin September 30, 2004 and will continue until a successful candidate is found. Further information can be obtained at (417) 836-5800 or fax to (417) 836-6006, or visit our web site at geosciences.smsu.edu. Women and minority candidates are encouraged to apply. EO/AA employer.

WELL LOGGING
PETROPHYSICIST AND GEOPHYSICIST
PETROLEUM INSTITUTE, ABU DHABI

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

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

The Petroleum Institute is a small, highly focused, teaching and research institute that offers educational programs that will lead to B.Sc., M.Sc., and Ph.D. degrees in engineering and petroleum geosciences. Staff will have the resources to equip laboratories with up-to-date analytical equipment and computer software and hardware to support teaching and research.

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

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

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

BIOGEOSCIENCE OR PALEONTOLOGY
UNIVERSITY OF OREGON

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

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

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

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

TENURE TRACK POSITION IN
SEDIMENTARY GEOLOGY, TEXAS TECH UNIVERSITY

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

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

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

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

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

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

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

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

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

and the impact of urban sprawl.

Applicants should send a vita including experience, publications, statement of teaching philosophy and research interests, and names of three references. Applicants should discuss how they would include undergraduates in their research.

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

DEPARTMENT OF GEOLOGY
UNIVERSITY OF MARYLAND, COLLEGE PARK

The Department of Geology at UMd is searching for an outstanding scientist as a faculty colleague in the following broadly-defined areas: structural geology and tectonics, neotectonics or tectonophysics. A Ph.D. is required at the time of appointment and the starting date is flexible. The Department anticipates filling this position at the rank of Assistant Professor, but a senior hire may be considered under exceptional circumstances. Salary will be commensurate with experience. The appointee is expected to develop and maintain an active, externally-funded research program that will involve both graduate and undergraduate students, and to participate fully in teaching at the graduate and undergraduate levels, including courses in structural geology and tectonics/neotectonics/tectonophysics, and introductory courses at the freshman level. We particularly seek applicants who will interact with and complement existing research programs; additionally, the Department encourages interdisciplinary approaches to the study of the Earth and participates in the Earth System Science Interdisciplinary Center.

The University of Maryland is an affirmative action/equal employment opportunity employer. For best consideration, applications should be submitted by October 22, 2004, preferably electronically, and should be submitted to: Chair, Search Committee, Department of Geology, University of Maryland, College Park, MD 20742, USA (at geo-apply@umd.edu). Applicants should provide a statement describing research and teaching interests, indicating how s/he envisions contributing to the Department's research and teaching activities, current curriculum vitae and names and addresses of at least four referees. Applicants should ask a minimum of two of these nominated referees to send letters directly to the Chair of the Search Committee as soon as possible (at geo-apply@umd.edu).

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

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

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

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

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

STRUCTURAL GEOLOGY/TECTONICS
TEXAS CHRISTIAN UNIVERSITY

The Department of Geology, Texas Christian University (TCU), invites applications for a tenure-track position in Structural Geology/Tectonics. Initial appointment will be as an Assistant Professor. Preference will be given to applicants who can start in January of 2005, but consideration will also be given to applicants who cannot begin until the following fall. The department is seeking an energetic scientist with a strong theoretical background and a commitment to fieldwork. TCU operates on the teacher-scholar model. Faculty are expected to combine excellence in the classroom with an active research program, including supervision of M.S. theses. Normal teaching duties are two courses per semester, including Introductory and Structural Geology, as well as graduate courses in the candidate's specialty. For more information about the Department of Geology, visit http://www.geo.tcu.edu.

Applicants should send a vita, statement of teaching and research interests, and contact information for three references to: R.E. Hanson, Chair, Department of Geology, Box 298830, Texas Christian University, Fort Worth, TX 76129. Review of applications will begin September 15 and continue until the position is filled. TCU is an AA/EEO employer and encourages a diversity of applicants.

COLBY COLLEGE
ONE SEMESTER APPOINTMENT
SPRING SEMESTER 2005

The Department of Geology invites applications for a one-semester replacement position beginning on 1 February and terminating 31 May 2005. The successful applicant will teach three undergraduate course equivalents including a lecture section of Introductory Geology and an upper division course with laboratory in the applicant's area of expertise. The area of applicant expertise is open, but should complement those in the department. Colby is a highly selective liberal arts college recognized for excellence in undergraduate education and for close student-faculty interaction. A Ph.D. or ABD with teaching experience is preferred. The review of applications will begin on 15 September 2004 and will continue until the position is filled.

Applicants should submit a letter of application, c.v., statement of teaching interests and experience, and names, e-mail addresses, and contact information for three (3) referees. All materials should be sent to: Dr. Robert A. Gastaldo, Chair, Department of Geology, 5807 Mayflower Hill Drive, Waterville, ME 04901. Colby is an Equal Opportunity/Affirmative Action employer, committed to excellence through diversity, and strongly encourages applications and nominations of persons of color, women, and members of other under-represented groups. For more information about the College, please visit the Colby web site: www.colby.edu.

Department of Geosciences
PRINCETON UNIVERSITY

The Department of Geosciences at Princeton University is seeking applications for a new tenure-track faculty position in the areas of solid-earth geophysics or geochemistry. We anticipate hiring at the assistant professor level, although candidates at a higher rank may be considered under exceptional circumstances. We are particularly interested in outstanding individuals who will interact with and complement existing research programs in global seismology, mineral physics, the physics of earthquakes, and structural geology (see our website at http://geoweb.princeton.edu). Examples of appropriate research areas include, but are not limited to, computational dynamics of the mantle and/or lithosphere, crustal deformation and active tectonics, physical or chemical evolution of the Earth or terrestrial planets, mantle petrology, earthquake seismology, and mineral or rock physics.

Applicants should send a curriculum vitae, including a publication list, a statement of research and teaching interests, and contact information for three references to: Search Committee, Department of Geosciences, Guyot Hall, Princeton University, Princeton, NJ 08544. The starting date is flexible, ranging up to September 2006. Evaluation of applications will begin immediately; interviews of candidates will begin in September 2004 and continue until the position is filled. Princeton University is an Affirmative Action Equal Opportunity Employer; women and members of minority groups are encouraged to apply. For general information about applying to Princeton and how to self-identify, please link to http://web.princeton.edu/sites/dof/ApplicantsInfo.htm.

tion. The successful candidate may also wish to collaborate with the National Center for Geographic Information and Analysis and the Center for Computational Research at the University at Buffalo. Teaching duties will involve undergraduate and graduate level courses in the candidate's specialties. Successful candidates must have a Ph.D. degree at the time of appointment. Apply with a statement of teaching and research goals and a curriculum vitae, including published research, grant support, and names of at least three references to: Chair, Search Committee, Department of Geology, 876 Natural Science Complex, University at Buffalo, The State University of New York, Buffalo, NY 14260-3050. More information about our department can be found at: http://www.geology.buffalo.edu. We will begin evaluating applicants November 1, 2004. Posting No. F-4039. The University at Buffalo is an Equal Opportunity Employer/Recruiter.

GEOBIOLOGY
UNIVERSITY OF WASHINGTON

The Department of Earth and Space Sciences at the University of Washington invites applications for a tenure-track position in geobiology. Preferred research areas include, but are not limited to, geomicrobiology, biogeochemistry, paleoecology and/or evolutionary paleobiology. We are particularly interested in individuals who use new genetic, microbiological, geochemical and/or computing techniques in their research and who can incorporate these into their teaching. Opportunities for collaboration exist with the Burke Museum, Program on Climate Change, Marine Geology & Geophysics, Atmospheric Sciences, Astrobiology Program, and departmental research groups in isotopic geochemistry, sedimentology/stratigraphy, Quaternary studies and geomorphology, among others.

Applicants should have the Ph.D. degree by the start of appointment and will be expected to participate in undergraduate and graduate teaching and independent research. In exceptional circumstances, appointment at the Associate Professor or Professor level may be considered for candidates who have demonstrated a commitment to mentoring underrepresented students in the sciences.

Applications, including a curriculum vitae, statement of research and teaching interests, and the names of four references, should be sent to: Search Coordinator (Geobiology), Dept. of Earth and Space Sciences, University of Washington, Box 351310, Seattle, WA 98195-1310. Priority will be given to applicants received before 8 October.

The University of Washington is building a culturally diverse faculty and strongly encourages applications from women and minority candidates. The University is an Equal Opportunity/Affirmative Action employer.

FACULTY POSITION/GEOLOGY

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

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

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

Opportunities for Students

Ph.D. Students Wanted. Program in Infrastructure and Environmental Systems. University of North Carolina—Charlotte. The interdisciplinary program in **Infrastructure and Environmental Systems** at UNC Charlotte is accepting applications for PhD students for the 2004-2005 academic year. Full funding, including out-of-state tuition waivers, is available. Areas of student research include: biogeochemistry, applied climatology, coastal processes, contaminant transport, engineering geology, environmental geology, fluvial processes, geochemistry, geotechnical engineering, surface and groundwater hydrology, landfill design, tropical meteorology, mineralogy, Quaternary geology, sedimentology, stratigraphy, site remediation, slope stability, soil geomorphology, structural geology, surficial processes, vadose zone processes, waste containment in soils, watershed analysis and numerical weather prediction. Students have access to extensive field and analytical equipment and facilities including IC, ICPMS, XRD, XRF, GPR, grain size analysis and GIS laboratories. We are located in the beautiful Piedmont of North Carolina within easy access to pristine beaches and to the Blue Ridge Mountains of North and South Carolina. Application deadline: 7/15/04 or until positions are filled. For more information contact jadiemer@email.uncc.edu or visit http://www.uncc.edu/gradmiss/inesindex.html

earth scope Education and Outreach Manager

EarthScope invites applications for the position of EarthScope Education and Outreach Manager at the EarthScope Headquarters Office in Washington, DC. The successful candidate will be responsible for coordinating the development of a high-profile education program for EarthScope that emphasizes the integrated nature of the project and the importance of EarthScope's research initiatives.

EarthScope (www.earthscope.org) is the National Science Foundation's largest undertaking in solid Earth Sciences. It provides a unique opportunity for integrating scientific research and education while advancing the Earth Sciences with a diverse national audience. EarthScope will develop and coordinate educational activities, provide science and data products that are accessible to students, and create teaching modules that will allow EarthScope resources to be incorporated into an inquiry-based learning experience consistent with national educational standards.

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To apply, please mail your curriculum vitae, a statement of experience and interest, and contact information for three references to: Ms. Patricia Sheatsley (psheatsley@earthscope.org), EarthScope, 1200 New York Avenue, NW, Suite 700, Washington, DC 20005.

The review process will begin on September 15 and continue until a candidate is selected. EarthScope is an equal opportunity employer. Women, members of underrepresented groups, and persons with disabilities are encouraged to apply.

Due Date for Field Trip Proposals: December 1, 2004

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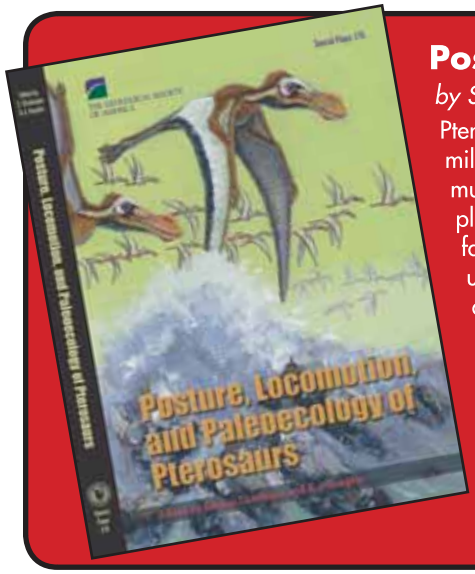

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by Sankar Chatterjee and R.J. Templin, 2004

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