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## **Wind erosion in the Qaidam basin, central Asia: Implications for tectonics, paleoclimate, and the source of the Loess Plateau**

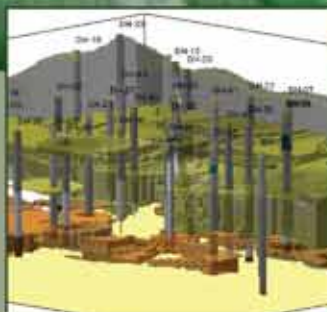


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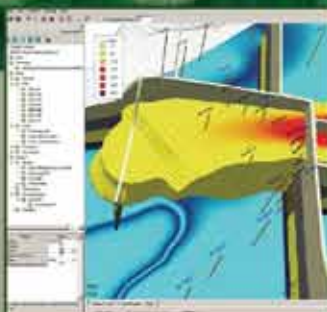
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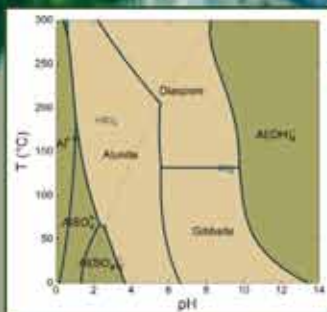
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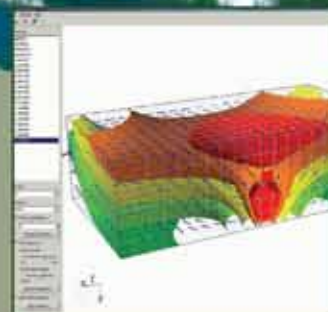


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**Managing Editor:** K.E.A. "Kea" Giles, [kgiles@geosociety.org](mailto:kgiles@geosociety.org), [gsatoday@geosociety.org](mailto:gsatoday@geosociety.org)

**Graphics Production:** Margo Sajban

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#### 4 Wind erosion in the Qaidam basin, central Asia: Implications for tectonics, paleoclimate, and the source of the Loess Plateau

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**Cover:** Field of wind-sculpted yardangs in the northwestern Qaidam basin. Photo by Paul Kapp. See "Wind erosion in the Qaidam basin, central Asia: Implications for tectonics, paleoclimate, and the source of the Loess Plateau," p. 4–10.



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# Wind erosion in the Qaidam basin, central Asia: Implications for tectonics, paleoclimate, and the source of the Loess Plateau

**Paul Kapp\***, **Jon D. Pelletier**, **Alexander Rohrmann\*\***, *Dept. of Geosciences, University of Arizona, 1040 E 4th St., Tucson, Arizona, 85721, USA*; **Richard Heermance**, *Dept. of Geological Sciences, California State University, Northridge, California 91330-8266*; **Joellen Russell**, *Dept. of Geosciences, University of Arizona, 1040 E 4th St., Tucson, Arizona, 85721, USA*; and **Lin Ding**, *Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing 100085, People's Republic of China*

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## ABSTRACT

Liquid water and ice are the dominant agents of erosion and sediment transport in most actively growing mountain belts. An exception is in the western Qaidam basin along the northeastern margin of the Tibetan Plateau, where wind and wind-blown sand have sculpted enormous yardang fields in actively folding sedimentary strata. Here, we present observations suggesting that since the late Pliocene, wind episodically (during glacial and stadial periods) removed strata from the western Qaidam basin at high rates ( $>0.12$ – $1.1$  mm/yr) and may have accelerated rates of tectonic folding. Severe wind erosion likely occurred during glacial and stadial periods when central Asia was drier and the main axis of the polar jet stream was located  $\sim 10^\circ$  closer to the equator (over the Qaidam basin), as predicted by global climate models. Reconstructed wind patterns, the estimated volume of Qaidam basin material removed by wind, and numerical models of dust transport all support the hypothesis that the Qaidam basin was a major source of dust to the Loess Plateau.

## INTRODUCTION

The 700-km-long, up to 300-km-wide Qaidam basin (Figs. 1 and 2A) encompasses one of the highest ( $\sim 2800$  m elevation) and driest ( $<50$  mm/yr precipitation in its western part) deserts on Earth, and it is actively shortening NE-SW in response to the ongoing collision between India and Asia (Tapponnier et al., 2001). A common inference, likely because of its low relief ( $<300$  m), intermontane and internally drained setting, and thick accumulations of late Cenozoic sediment, is that the Qaidam basin is actively filling with sediment. However, roughly one-third of the modern Qaidam basin floor ( $\sim 3.88 \times 10^4$  km<sup>2</sup>) actually exposes folded sedimentary strata (Fig. 2A) exhumed since the Pliocene due to uplift and wind erosion. Severe wind erosion is demonstrated in the western Qaidam basin by the presence of extensive fields of mega-yardangs (Figs. 2A–2C and 3A) (Goudie, 2007), which are ridges (and parallel troughs/

pans) carved in cohesive material by strong, unidirectional winds and saltating particles carried by the wind, with spacing and relief on the order of hundreds of meters and tens of meters (locally up to  $\sim 50$  m), respectively. In most places, wind-carved substrata consist of relatively friable, Plio-Quaternary lacustrine deposits.

Yardang ridges form parallel to and taper in the direction of prevailing winds. The geometries of yardangs, and dune forms in ergs where present, reveal the prevailing wind pattern during their development (Fig. 2A). Northwesterly winds entered the Qaidam basin through topographic lows in the Altyn Tagh Range along its northwestern margin (Fig. 2A; Halimov and Fezer, 1989). Moving from west to east in the basin, the wind directions become more westerly, paralleling the trends of the  $>5000$ -m-high basin-bounding mountain ranges (Fig. 2A). Located downwind of the Qaidam basin is one of the most voluminous and best-exposed accumulations of Neogene-Quaternary loess on Earth—the Loess Plateau (e.g., Kukla, 1987; Porter, 2007) (Fig. 1). The alternating loess/paleosol stratigraphy of the Loess Plateau provides one of the richest terrestrial records of climate change since the Pliocene. Loess accumulation occurred primarily during glacial and stadial periods, when climatic conditions were drier in central Asia because of a weakened East Asian summer monsoon (e.g., An, 2000; Porter, 2007). Knowledge of the source regions for the loess, and how they have varied through time, is critical for assessing numerical models of atmospheric circulation during the Pliocene and Quaternary and the provenance of the nutrient-rich dust transported by high-level westerly winds into the Pacific Ocean, which may have increased marine productivity and contributed to the drawdown of atmospheric carbon dioxide during glacial periods (Rea, 1994; Bopp et al., 2003; Mahowald et al., 2006). In addition, Chinese loess input into the ocean has strongly altered seawater chemistry (e.g., Jacobson, 2004). Although it is widely argued that the bulk of Loess Plateau deposits was sourced from the Gobi and adjacent sand deserts (e.g., Sun, 2002; Sun et al., 2008), observations of spatially extensive fields of yardangs and the prevailing northwesterly to westerly wind pattern in the Qaidam basin suggest that its importance as a Loess Plateau source may presently be underappreciated.

## HISTORY OF QAI DAM WIND EROSION

The wind erosion that produced the modern Qaidam yardangs must be younger than late Pleistocene because lacustrine strata of this age are widely exposed in the wind-eroded part of the basin (Pan et al., 2004). However, it does not appear that

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\*pkapp@email.arizona.edu

\*\*Now at Institut für Geowissenschaften, Universität Potsdam, 14476 Potsdam, Germany

the Qaidam basin is presently undergoing severe wind erosion. No major dust-producing wind storms have been documented in the Qaidam during the past ~50 years (Sun et al., 2001). Also, the modern Qaidam yardangs are in many places armored with a decimeter-scale thick crust/paleosol of strongly indurated salt (Fig. 3B). This salt crust is not restricted to lower elevation areas of the basin where the salt could have been

rapidly leached from the water table, but it is also in topographically higher areas, consistent with landform stability.

Based on the alternating wet and dry conditions characteristic of interglacial/interstadial and glacial/stadial periods, respectively, in central Asia during the Plio-Quaternary, it seems reasonable to speculate that the Qaidam basin experienced alternating episodes of sediment accumulation and wind erosion

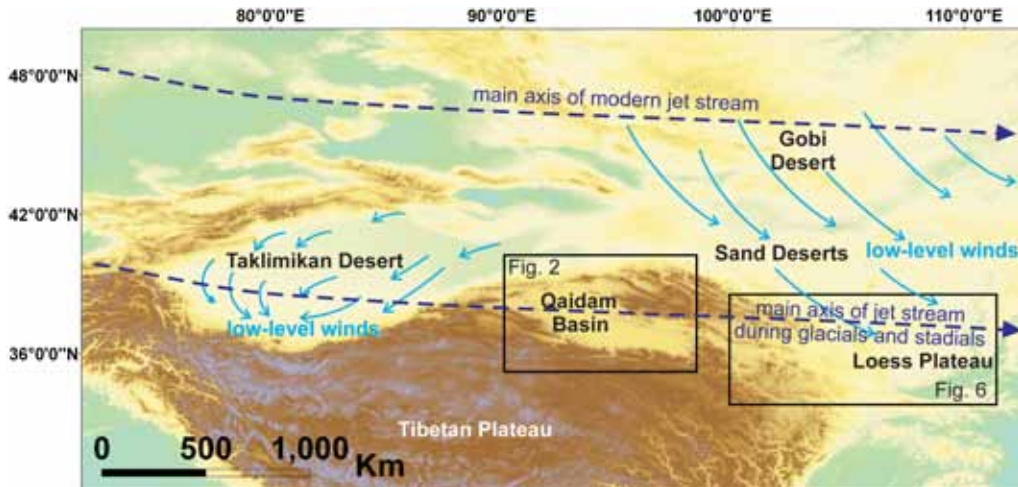


Figure 1. Shaded relief map of central Asia. Light-blue arrows indicate prevailing low-level wind directions. Dark-blue, dashed lines indicate main axis of polar jet stream in modern winter climate (over Gobi Desert; position from An, 2000) and that predicted by global climate models during glacial/stadial episodes (over Qaidam basin ~10° closer to the equator; Toggweiler and Russell, 2008).

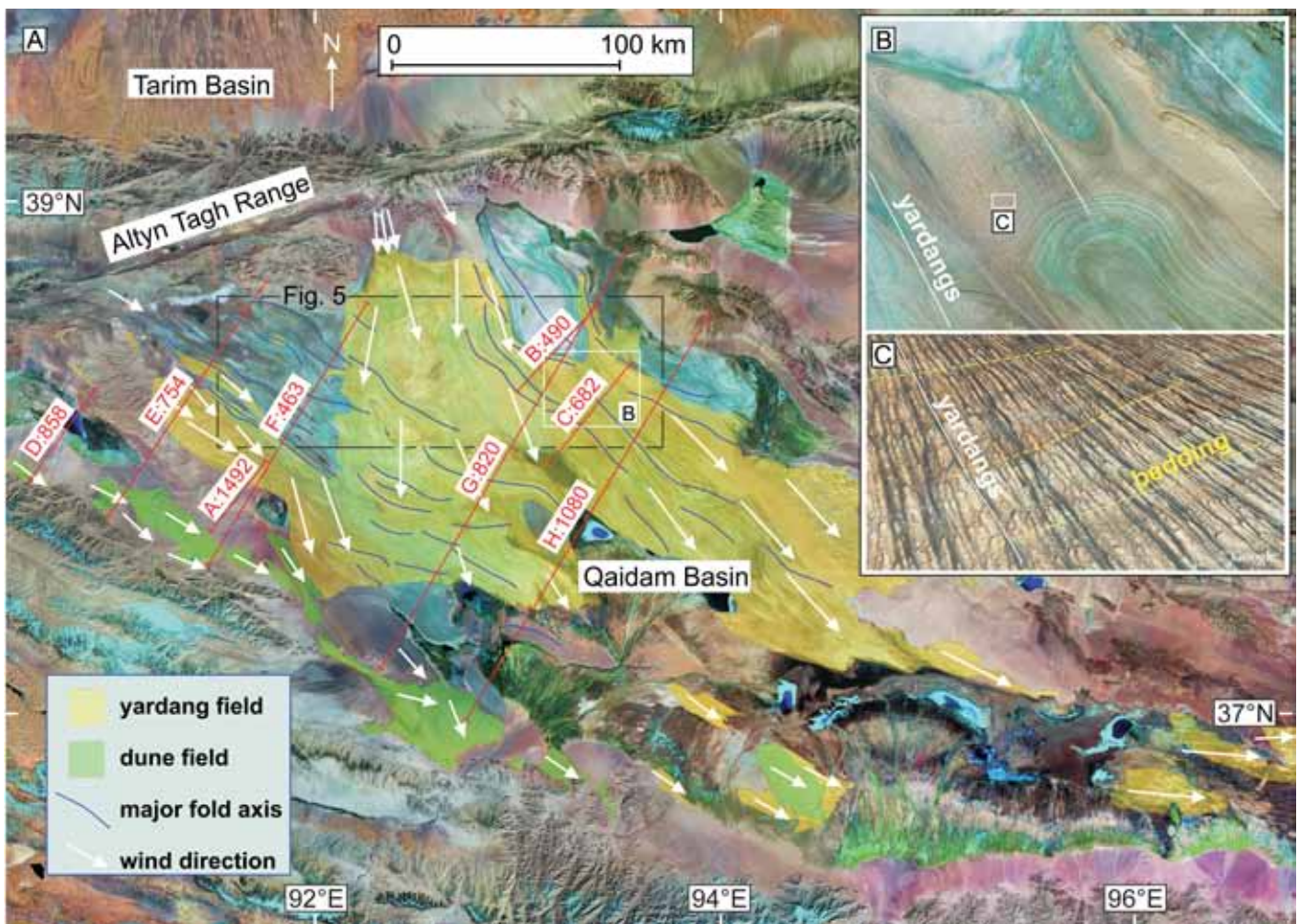


Figure 2. (A) Landsat 7 image of Qaidam basin region. Red lines indicate locations of cross sections for which values of erosion, averaged across length of line, were determined (values in white boxes; units in meters). (B) and (C) Google Earth images showing yardang fields that have developed in folded Pliocene-Quaternary sedimentary strata. Spacing between major yardangs is ~100 m. Width of view in 2B is ~50 km.



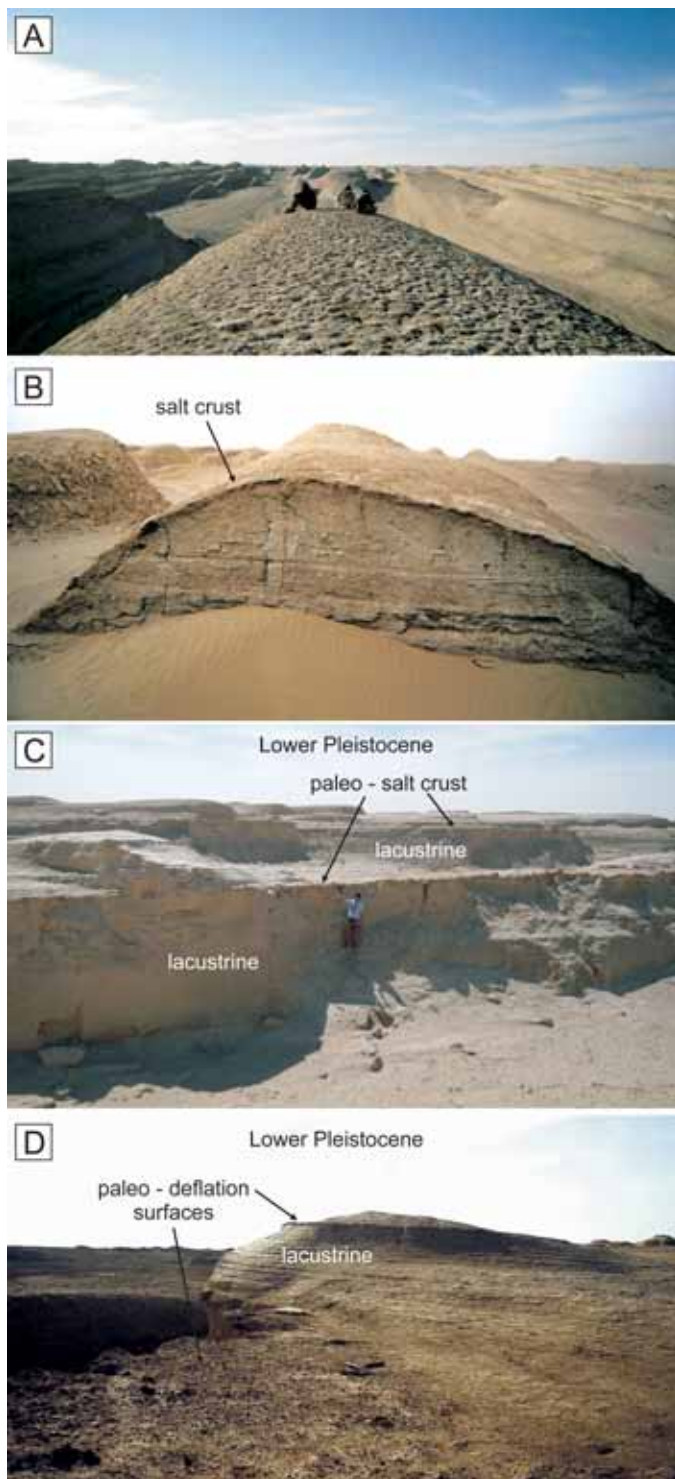


Figure 3. (A) Mega-yardangs sculpted in mainly lacustrine Pleistocene strata within the west-central Qaidam basin. (B) Roadcut exposure looking parallel to long axis of yardang. In many places, yardangs are armored in a resistant salt crust that is here ~35 cm thick. (C) Salt crust and (D) deflation lag deposits interbedded with lower Pleistocene lacustrine strata in the west-central Qaidam basin.

in phase with Loess Plateau paleosol development and loess accumulation. A supporting, preliminary investigation of Plio-Pleistocene basin fill in the west-central Qaidam basin shows that lacustrine sedimentation was punctuated by periodic episodes of subaerial exposure and wind erosion. The latter is evidenced by the presence of salt paleosols/crusts (Fig. 3C), deflation lag deposits (Fig. 3D), wind-storm deposits, paleopans filled with lacustrine and/or eolian deposits, and even paleoyardangs separating meter-scale parasequences of lacustrine strata (Heermance et al., 2009). Except for perhaps along the crests of large anticlines, which parallel topographic highs in the basin, sediment accumulation during periods of lacustrine deposition must have exceeded the thickness of material removed when wind erosion was active in order to lead to positive net sediment accumulation, the preservation of paleoyardangs, and the significant thicknesses of Plio-Quaternary fill exposed in the region. The ongoing folding in the Qaidam basin coupled with the most recent episode of severe wind erosion led to the preservation and exposure of this stratigraphic (and likely very rich paleoclimatic) record.

### RATES OF WIND EROSION

Quaternary wind-erosion rates have not been quantified in the Qaidam basin but must be significant. The modern Qaidam yardangs post-date occupation of large parts of the basin by lakes at sometime between 120 ka and 400 ka (Mischke et al., 2010). The development of yardangs with 50 m of relief requires minimum time-averaged erosion rates in the 0.12–0.42 mm/yr range in the troughs between yardangs, assuming an initial flat surface into which the yardangs were sculpted.

Time-averaged erosion rates can also be estimated over a longer time scale. Industry seismic-reflection profiles show that sediment accumulation was continuous across the entire Qaidam basin until ca. 2.8 Ma, when the appearances of growth strata indicate accelerated growth of folds within the western Qaidam basin (Zhou et al., 2006; Yin et al., 2008). The absence of angular unconformities imaged in ca. 2.8 Ma and older Neogene strata indicate that the erosion of Qaidam basin folds has occurred since 2.8 Ma. We use geological cross sections (Figs. 4 and DR1<sup>1</sup>) to estimate how much strata have been removed from above Qaidam folds since 2.8 Ma (providing estimates of time-averaged erosion rates). Sedimentary deposits younger than 2.8 Ma in the western Qaidam basin are overwhelmingly evaporative lacustrine/playa, indicative of closed-basin conditions (Pan et al., 2004; Fang et al., 2008; Heermance et al., 2009). Hence, removal of sediment from the western Qaidam basin must have occurred by wind.

Hundreds to thousands of meters of strata have been removed from above Qaidam basin folds since ca. 2.8 Ma based on geometric constraints provided by published regional cross sections (Zhou et al., 2006) (Fig. DR1 [see footnote 1]) and our own, more local cross sections constructed from unpublished 1:200,000-scale Chinese geological maps (Fig. 4). The numbers shown for individual cross-section lines (Fig. 2) indicate the line-averaged value of material eroded. These estimates are rough given uncertainties about how stratal thicknesses may vary across anticlines and the fold-growth histories. Encouraging, however, are the similar

<sup>1</sup>GSA supplemental data item 2011135, supplemental cross sections and notes on dust-transport modeling, is available online at [www.geosociety.org/pubs/ft2011.htm](http://www.geosociety.org/pubs/ft2011.htm). You can also request a copy from *GSA Today*, P.O. Box 9140, Boulder, CO 80301-9140, USA; [gsatoday@geosociety.org](mailto:gsatoday@geosociety.org).

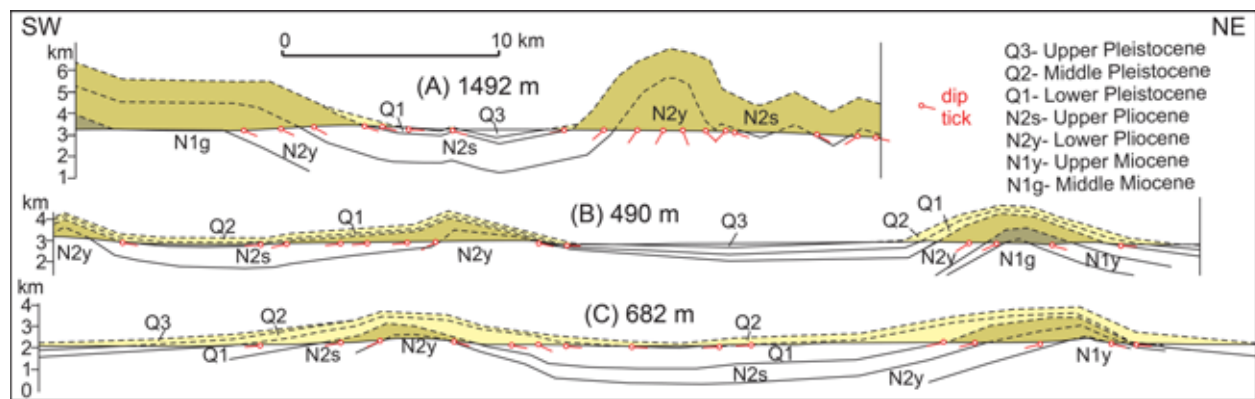


Figure 4. Geological cross sections constructed from unpublished 1:200,000-scale Chinese geological maps, showing minimum estimates of the amount of material removed from above Qaidam basin folds. Locations of lines are indicated on Figure 2. An effort was made to minimize the amount of material eroded, for instance, by thinning or pinching out units above the folds and not including material eroded from above some of the wind-eroded synclines where no bedding orientation data are available. In addition, we are unable to account for the possibly significant episodic wind erosion that could have contributed to thinning of the upper Pliocene and younger units.

values obtained from the local and regional cross sections, and that the basin-wide average erosion value (average of all values weighted by length of cross section = 820 m) is identical to the value determined for the longest line across the central part of the wind-eroded basin (820 m; Fig. 2). This value, in turn, yields a basin-wide average erosion rate of 0.29 mm/yr over the past 2.8 Ma, within the range of the erosion-rate estimates determined using previous lake occupation as a reference datum (0.12–0.42 mm/yr). There are localized erosion hotspots above anticline crests where up to 3 km of strata have been removed (Figs. 4 and DR1 [see footnote 1]), corresponding to a time-averaged erosion rate of 1.1 mm/yr. These are minimum erosion rate estimates for when wind erosion was active because they are averaged over a time interval when erosion was not continuously active (excluding perhaps along the crests of the largest anticlines) but instead alternated with episodes of sediment accumulation.

### IMPLICATIONS FOR TECTONIC-CLIMATE INTERACTIONS

Our estimates of wind-erosion rates in the sandblasted portion of the Qaidam basin are comparable to rates of fluvial and glacial erosion in tectonically active mountain ranges. The efficacy of wind in removing sediment from the Qaidam basin may be attributed to a combination of strong unidirectional winds, the nature of the material being eroded (mainly young, friable lacustrine deposits), and ongoing folding that brings a continuous supply of this material toward the surface. At least locally above crests of actively growing anticlines, the erosion rates are comparable to those in the Himalaya (~1 mm/yr in the Miocene and accelerating to 2–3 mm/yr during the past few million years; Vance et al., 2003; Rahl et al., 2007) and other orogens where it has been proposed that erosion has had a positive feedback relationship with rock deformation and rock uplift (e.g., Beaumont et al., 2001; Simpson, 2004; Whipple, 2009). The possibility of an analogous positive feedback relationship between focused erosion and rock deformation in the Qaidam basin, except in response to wind rather than fluvial or glacial processes, is intriguing.

An outstanding issue is the extent to which tectonics led to enhanced wind erosion in the Qaidam basin and vice versa. Tectonically driven acceleration of the northeastward growth of the Tibetan Plateau since the late Miocene (e.g., Molnar, 2005), with a possible pulse of mountain building along the northern and eastern margins of the Qaidam basin at 3.6–2.6 Ma (e.g., An et al., 2001), may have helped establish the hyper-arid conditions conducive to wind erosion in the Qaidam basin. In the case of the Qaidam basin, however, the onset of severe wind erosion may have enhanced fold growth. A supporting observation is the unlikely coincidental, coeval (at 2.8–2.5 Ma) acceleration of loess accumulation on the Loess Plateau (An, 2000; Porter, 2007), suggesting enhanced wind erosion in its source region(s) at this time and initiation of rapid fold growth in the western Qaidam basin, as indicated by growth strata (Zhou et al., 2006). The onset of severe wind erosion corresponds in time with an increase in global ice volume and the onset of the glacial/interglacial cycles. While debate persists, a recent and popular explanation attributes this change in global climate to the establishment of the Indonesian Gateway rather than to mountain building or other climate drivers (e.g., Fedorov et al., 2006; Karas et al., 2009). Higher resolution data on the history of wind erosion and folding in the western Qaidam basin are needed to test the idea that climate change (wind erosion) may have locally accelerated tectonics.

An analysis of Qaidam fold geometries and their relationship to the prevailing wind directions reconstructed from modern yardang orientations (Fig. 5) raises the additional possibility that wind erosion may have influenced fold geometry and kinematics. The regional shortening direction along the northeastern margin of the Tibetan plateau is NE-SW (Tapponnier et al., 2001; Zhang et al., 2004). Hence, we would expect the axial traces of Qaidam folds to trend NW-SE. However, in many places, axial traces trend more E-W than expected and many folds are crescent-shaped in map view, with axial trace trends that vary from NW-SE to more E-W orientations. Many Qaidam anticlines are fault-propagation folds with steeper dipping forelimbs (indicated as dotted yellow lines on Fig. 5) and shallower





Figure 5. Landsat 7 image of the northwestern Qaidam basin (location shown on Fig. 2A). White arrows—prevailing wind direction during yardang development; yellow lines—axial traces of fault-propagation anticlines; yellow dotted lines—steeper forelimbs of anticlines (perpendicular to propagation direction).

dipping backlimbs. For every anticline shown on Figure 5, the forelimbs are located on the northern sides of the axial traces, indicating that the anticlines are propagating northward to northeastward, roughly in the up-wind direction. The latter observation may be fortuitous; the fold geometries may be controlled by reactivation or inversion of preexisting south- to southwest-dipping faults in the underlying basement. However, we raise another possibility that northerly to northwesterly winds caused more erosion on the northern forelimbs, where winds were forced to move up and over the anticlines, relative to the backlimbs. This enhancement of erosion along the northern forelimbs might have facilitated northward fault propagation, which in turn would create a topographically more abrupt forelimb that would further enhance and localize wind erosion. In essence, we suggest that the crescent-shaped geometries in map view and northward propagation direction of Qaidam folds may be a consequence of the superposition of the regional tectonic compressive stress in the NE-SW direction and stresses related to spatially non-uniform erosional unloading by wind.

### IMPLICATIONS FOR PALEOCLIMATE AND SOURCE OF LOESS PLATEAU

The estimated volume of material removed from the Qaidam basin by wind is  $3.2 \times 10^4 \text{ km}^3$  (basin average erosion estimate of  $820 \text{ m} \times$  modern yardang area of  $3.88 \times 10^4 \text{ km}^2$ ), equivalent to more than half of the total volume of Loess Plateau deposits (Porter, 2007; average thickness of  $150 \text{ m} \times$  area =  $6.0 \times 10^4 \text{ km}^3$ ). The dominantly lacustrine strata removed from the Qaidam basin includes abundant silt and sand, and thus could be a source for the relatively coarse loess deposits of the Loess Plateau. The proportion of wind-eroded material that may have been redistributed to and stored within the eastern Qaidam basin is unknown. Nevertheless, this volume comparison combined with the northwesterly to westerly wind pattern in the Qaidam basin (Fig. 2) and the downwind position of the Loess Plateau warrant reconsideration of a source-sink relationship between the two (e.g., Bowler et al., 1987).

There are two major arguments challenging this proposition and that have strongly influenced current thinking. First, the bulk of central Asian dust entrained into the atmosphere by

low-level wind storms during the past ~50 years of monitoring was sourced from the Gobi and adjacent sand deserts, as well as the Tarim basin (Taklimakan Desert) (Zhang et al., 2003a, 2003b; Sun et al., 2008) (Fig. 1). In the modern winter to spring climate, the main axis of the polar jet stream is located over the Gobi region (Fig. 1; An, 2000)—the locus of modern dust storms. During glacial and stadial periods, global climate models suggest that the main axes of the high-level westerlies in both the northern and southern hemispheres shift  $\geq 10^\circ$  in latitude toward the equator as a consequence of a decreased thermal contrast in the middle of the atmosphere (Yin, 2005; Williams and Bryan, 2006; Toggweiler and Russell, 2008). This places the main axis of the jet stream directly over the Qaidam basin (Fig. 1) during glacial and stadial periods, when we propose that wind erosion was most severe.

Second, the spatial variations in thickness (and grain size, which scales positively with thickness) of Loess Plateau deposits (Fig. 6A) (Zhang et al., 1999; Han et al., 2007) have been widely interpreted to support the hypothesis that modern conditions of loess transport by low-level northerly and northwesterly winds are applicable throughout the Pliocene-Quaternary. However, we show here using numerical models of dust transport that the spatial variations in thickness are consistent with westerly winds and a Qaidam basin source.

Atmospheric transport of particulate matter can be modeled as a combination of turbulent diffusion, downwind advection, and gravitational settling. Figures 6B and 6C illustrate deposition maps corresponding to steady-state advection-diffusion-settling models for dust emanating from an elevated (1500 m) point source located above the westernmost edge of the Loess Plateau. The source is elevated because the dust emanating out of the wind pass of the Qaidam basin is located 1500 m higher than the Loess Plateau. Additional model parameters include the mean wind velocity  $u$  (~10 m/s), the Rouse number  $v$  (~0.3), and the turbulent diffusivity (which varies with elevation in the model, but at the source elevation of 1500 m above the substrate it has a value of ~100  $\text{m}^2/\text{s}$ ; see supplemental data text [footnote 1] for model details).

Model results are shown in Figure 6B for the reference case of  $u = 10 \text{ m/s}$ ,  $v = 0.3$ , and  $K_z(b) = K_x = 100 \text{ m}^2/\text{s}$ . The value of the source emission rate was scaled to match the observed



maximum thickness of deposits in the Loess Plateau. The basis for this scaling is the similar order of the estimated volume of material eroded from the Qaidam basin and the volume of deposits in the Loess Plateau. For dust particles fine enough to be suspended in the atmosphere (i.e.,  $v$  significantly  $<1$ ), the model results scale with the parameter  $b^2u/K_z(b)$  (where  $b$  is the source elevation above the substrate), which has units of length. For the reference case (Fig. 6B),  $b^2u/K_z(b) = 225$  km. This value represents the distance between the point source location and the distance downwind from the source where the highest dust deposition rates are predicted. The observed pattern of loess thickness (Fig. 6A) corresponds quite closely with the predicted pattern. The sensitivity of dust deposition patterns corresponding to different values of  $u$  and  $K_z(b)$  can be determined by calculating  $b^2u/K_z(b)$  and stretching or contracting the downwind deposition patterns linearly relative to the reference case value of 225 km. For a range of reasonable  $u$  and  $K_z(b)$  values (i.e.,  $u = 5\text{--}15$  m/s,  $K_z(b) = 50\text{--}150$  m<sup>2</sup>/s), the downwind distance of the deposition “hotspot” varies within a range of 75 to 675 km.

Additional model details (including the justification and effects of the N-S wind velocity gradient included in Fig. 6C) are given in the supplemental data text (see footnote 1). Additional, second-order differences between model results and observed thickness may be explained by our hypothesis that dust is largely sourced from the Gobi region during interglacial and interstadial periods. However, since dust fluxes were 2–3 times greater during glacial episodes compared to interglacial episodes (Rea, 1994), in terms of volume percent, the Qaidam basin is likely the dominant source of loess to the Loess Plateau. Furthermore, our modeling work suggests that the turbulent dispersion of dust in the atmosphere promotes loess depositions that are larger in spatial extent than their source regions. As such, it is difficult to envision a scenario in which dust from the Gobi, Taklimakan, and other deserts of northern China and southern Mongolia (an area thousands of kilometers in extent) could have been concentrated into the much smaller area defined by the thickest ( $>100$  m) deposits of the Loess Plateau.

## CONCLUSIONS

The western Qaidam basin exposes enormous fields of yardangs sculpted by northwesterly to westerly winds in actively folding sedimentary strata. Emerging stratigraphic evidence suggests that the western Qaidam basin underwent alternating episodes of lacustrine deposition and wind erosion since the late Pliocene, which we hypothesize were in phase with episodes of paleosol formation and loess accumulation, respectively, in Loess Plateau deposits. Cross sections show that hundreds to thousands of meters of vertical strata have been removed from above Qaidam basin folds since 2.8 Ma, when the rate of fold growth accelerated. Given the prevalence of closed-basin conditions since at least the Pliocene, this material must have been transported out of the western Qaidam basin by wind. When active, wind erosion occurred at substantial rates ( $>0.12$  mm/yr), particularly above anticline crests ( $>1$  mm/yr). The coeval acceleration at 2.8–2.5 Ma of Qaidam basin fold growth and wind erosion in central Asia, and the crescent-shaped map patterns and consistently up-wind propagation

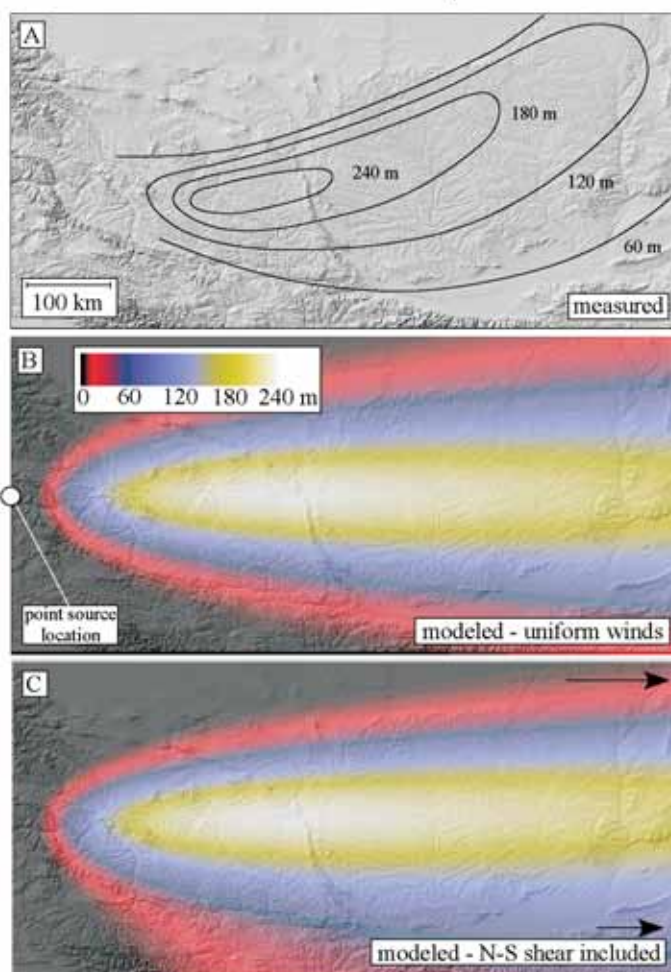


Figure 6. (A) Shaded relief topography of Loess Plateau with loess thickness contours superimposed (Nugteren and Vandenberghe, 2004). (B) Color map of predicted loess thickness for reference case solution. (C) Color map of predicted loess thickness with north-south wind velocity gradient included; otherwise, this model result corresponds to same parameters as in (B).

directions of Qaidam basin anticlines, raise the intriguing possibility that wind erosion enhanced and altered the kinematics of fold growth. We hypothesize that severe wind erosion in the Qaidam basin was mostly active during glacial and stadial periods when central Asia was drier and the main axes of the polar jet streams shifted toward the equator. The latter, in turn, shifted the source of Loess Plateau deposits from the Gobi and adjacent sand deserts (during interglacial conditions like those of the modern) to the Qaidam region.


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## REFERENCES CITED

An, Z., 2000, The history and variability of the East Asian paleomonsoon climate: *Quaternary Science Reviews*, v. 19, p. 171–187.

- An, Z., Kutzbach, J.E., Prell, W.L., and Porter, S.C., 2001, Evolution of Asian monsoons and phased uplift of the Himalaya-Tibetan plateau since late Miocene time: *Nature*, v. 411, p. 62–66.
- Beaumont, C., Jamieson, R.A., Nguyen, M.H., and Lee, B., 2001, Himalayan tectonics explained by extrusion of a low-viscosity crustal channel coupled to focused surface denudation: *Nature*, v. 414, p. 738–742.
- Bopp, L., Kohfeld, K.E., Le Quere, C., and Aumont, O., 2003, Dust impact on marine biota and atmospheric CO<sub>2</sub> during glacial periods: *Paleoceanography*, v. 18, p. 1046, doi: 10.1029/2002PA000810.
- Bowler, J.M., Chen, K., and Yuan, B., 1987, Systematic variations in loess source areas: Evidence from Qaidam and Qinghai basins, western China, in Tunghsheng, L., ed., *Aspects of Loess Research*: Beijing, China Ocean Press, p. 39–51.
- Fang, X., Wu, F., Han, W.-B., Wang, Y., Zhang, X., and Zhang, W., 2008, Plio-Pleistocene drying process of Asian inland-sporopollen and salinity records from Yahu section in the central Qaidam basin: *Quaternary Sciences*, v. 28, p. 874–882 (in Chinese).
- Fedorov, A.V., Dekens, P.S., McCarthy, M., Ravelo, A.C., de Menocal, P.B., Barreiro, M., Pacanowski, R.C., and Philander, S.G., 2006, The Pliocene paradox (mechanisms for a permanent El Niño): *Science*, v. 312, p. 1485–1489, doi: 10.1126/science.1122666.
- Goudie, A.S., 2007, Mega-yardangs: A global analysis: *Geography Compass*, v. 1, p. 65–81, doi: 10.1111/j.1749-8198.2006.00003.x.
- Halimov, M., and Fezer, F., 1989, Eight yardang types in Central Asia: *Zeitschrift für Geomorphologie*, v. 33, p. 205–217.
- Han, J., Chen, H., Fyfe, W.S., Guo, Z., Wang, D., and Liu, T.S., 2007, Spatial and temporal patterns of grain size and chemical weathering of the Chinese Red Clay Formation and implications for East Asian monsoon evolution: *Geochimica et Cosmochimica Acta*, v. 71, p. 3990–4004, doi: 10.1016/j.gca.2007.05.027.
- Heermance, R.V., Kapp, P., Rohrmann, A., and McCallister, A., 2009, Extreme winds during the Quaternary deduced from yardang preservation within lacustrine sediments in the Qaidam Basin, China: *Eos (Transactions, American Geophysical Union)*, v. 90, no. 52, Fall Meeting Supplement, Abstract PP21B-1341.
- Jacobson, A.D., 2004, Has the atmospheric supply of dissolved calcite dust to seawater influenced the evolution of marine <sup>87</sup>Sr/<sup>86</sup>Sr ratios of the past 2.5 million years?: *Geochemistry Geophysics Geosystems*, v. 5, Q12002, doi: 10.1029/2004GC000750.
- Karas, C., Nürnberg, D., Gupta, A.K., Tiedemann, R., Mohan, K., and Bickert, T., 2009, Mio-Pliocene climate change amplified by a switch in Indonesian subsurface throughflow: *Nature Geoscience*, v. 2, p. 434–438, doi: 10.1038/ngeo520.
- Kukla, G., 1987, Loess stratigraphy in central China: *Quaternary Science Reviews*, v. 6, p. 191–219.
- Mahowald, N.M., Muhs, D.R., Levis, S., Rasch, P.J., Yoshioka, M., Zender, C.S., and Luo, C., 2006, Change in atmospheric mineral aerosols in response to climate: Last glacial period, preindustrial, modern, and doubled carbon dioxide climates: *Journal of Geophysical Research*, v. 111, D10202, doi: 10.1029/2005JD006653.
- Mischke, S., Sun, Z., Herzsich, U., Qiao, Z., and Sun, N., 2010, An ostracod-inferred large middle Pleistocene freshwater lake in the presently hyper-arid Qaidam Basin (NW China): *Quaternary International*, v. 218, p. 74–85, doi: 10.1016/j.quaint.2009.03.002.
- Molnar, P., 2005, Mio-Pliocene growth of the Tibetan plateau and evolution of East Asian climate: *Palaeontologia Electronica*, v. 8, PE Article Number 8.1.2.
- Nugteren, G., and Vandenbergh, J., 2004, Spatial climatic variability on the Central Loess Plateau as recorded by grain size for the last 250 kyr: *Global and Planetary Change*, v. 41, p. 185–206, doi: 10.1016/j.gloplacha.2004.01.005.
- Pan, G., Ding, J., Yao, D., and Wang, L., 2004, Geological map of the Qinghai-Xizang (Tibet) Plateau and adjacent areas, with guidebook: Chengdu, Chengdu Cartographic Publishing House, 48 p.
- Porter, S.C., 2007, Loess Records—China, in Scott, A.E., ed., *Encyclopedia of Quaternary Science*: Oxford, Elsevier, p. 1429–1440, doi: 10.1016/B0-44-452747-8/00160-5.
- Rahl, J.M., Ehlers, T.A., and van der Pluijm, B.A., 2007, Quantifying transient erosion of orogens with detrital thermochronology from syn-tectonic basin deposits: *Earth and Planetary Science Letters*, v. 256, p. 147–161, doi: 10.1016/j.epsl.2007.01.020.
- Rea, D.K., 1994, The paleoclimatic record provided by eolian deposition in the deep sea: The geologic history of wind: *Reviews of Geophysics*, v. 32, p. 159–195.
- Simpson, G., 2004, Role of river incision in enhancing deformation: *Geology*, v. 32, p. 341–344, doi: 10.1130/G20190.1.
- Sun, J., 2002, Provenance of loess material and formation of loess deposits on the Chinese Loess Plateau: *Earth and Planetary Science Letters*, v. 203, p. 845–859.
- Sun, J., Zhang, M., and Liu, T., 2001, Spatial and temporal characteristics of dust storms in China and its surrounding regions, 1960–1999: Relations to source area and climate: *Journal of Geophysical Research*, v. 106, p. 10,325–10,333.
- Sun, Y., Tada, R., Chen, J., Liu, Q., Toyoda, S., Tani, A., Ji, J., and Isozaki, Y., 2008, Tracing the provenance of fine-grained dust deposited on the central Chinese Loess Plateau: *Geophysical Research Letters*, v. 35, L01804, doi: 10.1029/2007GL031672.
- Tapponnier, P., Xu, Z., Roger, F., Meyer, B., Arnaud, N., Wittlinger, G., and Yang, J., 2001, Oblique stepwise rise and growth of the Tibet Plateau: *Science*, v. 294, p. 1671–1677.
- Toggweiler, J.R., and Russell, J., 2008, Ocean circulation in a warming climate: *Nature*, v. 451, p. 286–288, doi: 10.1038/nature06590.
- Vance, D., Bickle, M., Ivy-Ochs, S., and Kubik, P.W., 2003, Erosion and exhumation in the Himalaya from cosmogenic isotope inventories of river sediments: *Earth and Planetary Science Letters*, v. 206, p. 273–288, doi: 10.1016/S0012-821X(02)01102-0.
- Whipple, K.X., 2009, The influence of climate on the tectonic evolution of mountain belts: *Nature Geoscience*, v. 2, p. 97–104, doi: 10.1038/NNGEO413.
- Williams, G.P., and Bryan, K., 2006, Ice Age winds: An aquaplanet model: *Journal of Climate*, v. 19, p. 1706–1715.
- Yin, A., Dang, Y.-W., Zhang, M., Chen, X.-H., and McRivette, M.W., 2008, Cenozoic tectonic evolution of the Qaidam basin and its surrounding regions (Part 3): Structural geology, sedimentation, and regional tectonic reconstruction: *GSA Bulletin*, v. 120, p. 847–876, doi: 10.1130/B26232.1.
- Yin, J.H., 2005, A consistent poleward shift of the storm tracks in simulations of 21st century climate: *Geophysical Research Letters*, v. 32, L18701, doi: 10.1029/2005GL023684.
- Zhang, P.-Z., Shen, Z., Wang, M., Gan, W., Burgmann, R., Molnar, P., Wang, Q., Niu, Z., Sun, J., Wu, J., Hanrong, S., and Xinzhao, Y., 2004, Continuous deformation of the Tibetan Plateau from global positioning system data: *Geology*, v. 32, p. 809–812, doi: 10.1130/G20554.1.
- Zhang, X.Y., Arimoto, R., and An, Z.S., 1999, Glacial and interglacial patterns for Asian dust transport: *Quaternary Science Review*, v. 18, p. 811–819.
- Zhang, X.Y., Gong, S.L., Shen, Z.X., Mei, F.M., Xi, X.X., Liu, L.C., Zhou, Z.J., Wang, D., Wang, Y.Q., and Cheng, Y., 2003a, Characterization of soil dust aerosol in China and its transport and distribution during 2001 ACE-Asia: 1. Network observations: *Journal of Geophysical Research*, v. 108, 4261, doi: 10.1029/2002JD002632.
- Zhang, X.Y., Gong, S.L., Zhao, T.L., Arimoto, R., Wang, Y.Q., and Zhou, Z.J., 2003b, Sources of Asian dust and role of climate change versus desertification in Asian dust emission: *Geophysical Research Letters*, v. 30, 2272, doi: 10.1029/2003GL018206.
- Zhou, J., Xu, F., Wang, T., Cao, A., and Yin, C., 2006, Cenozoic deformation history of the Qaidam Basin, NW China: Results from cross-section restoration and implications for Qinghai-Tibet Plateau tectonics: *Earth and Planetary Science Letters*, v. 243, p. 195–210, doi: 10.1016/j.epsl.2005.11.033.

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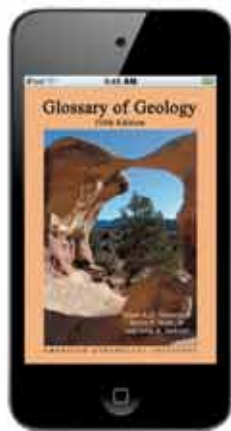


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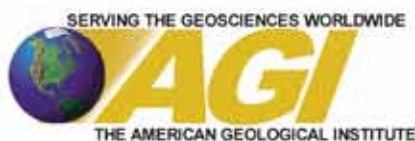
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# ARCHEAN to ANTHROPOCENE

*the past is the key to the future*

*Message from the*

## 2011 Technical Program Chair



Minneapolis, Minnesota, USA, is the focal point this year for geoscientists from around the world to assemble for the 2011 Geological Society of America Annual Meeting & Exposition. With a theme of *Archean to Anthropocene: The past is the key to the future*, the gathering will bring together government, academic, and private researchers, along with educators, students, and administrators, to exchange ideas and forge relationships that will play a large role in determining the direction and application of the geological sciences in the coming years.

Each year, the annual meeting is the highlight of the GSA's ambitious mission of *Science, Stewardship, Service*. Although it is organized by the Joint Technical Program Committee and overseen by the GSA Headquarters staff, the meeting truly belongs to and is a reflection of the membership at large. In recent years, there has been much debate, and yes, complaining, that the GSA Annual Meeting has too much applied science and not enough "real" or "hard" science; that there are too many education sessions, too many student presenters—undergraduate students, even; that the meeting has drifted away from a solid core of research about the natural world. However, because the annual meeting is a manifestation of the efforts of GSA's members, the technical program is a simple expression of the desires of that membership. If you do not agree with the makeup of the technical program, that simply means you do not agree with the wants, wishes, and needs of those who participated in creating the technical program. If you want to see different subject matter presented, please take advantage of the opportunity to submit your own topical session, field trip, or short course proposal for next year's meeting. In short, this is your meeting—make it what you want it to be. The meeting can only offer sessions that have been proposed by its participants.

That having been said, this year's meeting received a record-setting 223 topical session proposals! It is impossible to summarize the gamut of topics proposed. Examples include ultra-high pressure metamorphism, tectonics and civilization, phylogenetic approaches to paleobiology, toxic elements in the environment, lacustrine carbonates, gradients in karst aquifers, impact craters on Earth and other planets, new stratigraphic tools, human history and the hydrologic system, Laurentide ice sheet chronology, geophotography, deformation processes, geo-workforce preparation, involving undergraduates in research, geology and health, Great Lakes geology, and much, much more.

This year, GSA will offer a new presentation format option—the digital poster. Presenters will have a large monitor on which to display animations and interactive materials in addition to the standard poster board. Look for digital poster sessions in the list of proposed topical sessions. If your research lends itself to digital display format, please do submit an abstract and be a part of this presentation innovation.

It is easy to enjoy the Annual Meeting in a variety of ways. Beyond the presentation of new and exciting research, the meeting offers numerous opportunities to reconnect with old friends and to make new friends. Informal discussions outside of the sessions are an important part of the meeting. New technologies, publications, and teaching materials will be on display in the exhibit hall. As always—something for everyone.

Please consider submitting an abstract to one of the topical sessions or to the general discipline sessions. The Joint Technical Program Committee members and the officers and representatives of GSA's 17 Divisions and 58 Associated Societies are always at the ready to answer your questions and give guidance about your prospective abstract submittal. Feel free to utilize their expertise and knowledge of the process of creating and organizing the Annual Meeting. Help make the meeting the best it can be. Don't just attend the meeting—become part of the meeting.

**Dave Bush**, 2011 Technical Program Chair  
University of West Georgia, [dbush@westga.edu](mailto:dbush@westga.edu)



## ARCHEAN to ANTHROPOCENE

*the past is the key to the future*

## CALENDAR

**Registration**

opens in early June

**Housing**

opens in early June

**Space request deadline:**

Tues., 7 June

**Abstracts deadline:**

Tues., 26 July

**Early registration deadline:**

Tues., 6 Sept.

**Housing deadline:**

Tues., 6 Sept.

**Registration cancellation deadline:**

Mon., 12 Sept.

**Pre-Meeting Field Trips:**

Tues.–Sat., 4–8 Oct.

**Short Courses & Workshops:**

Fri.–Sun., 7–9 Oct.

**NEW TIMES!****Exhibits Opening:**

Sun., 9 Oct., 2–6:30 p.m.

**Presidential Address & Awards Ceremony:**

Sun., 9 Oct., 6:30–8:30 p.m.

**Awards & Welcoming Reception:**

Sun., 9 Oct., 8:30–9:30 p.m.

**TECHNICAL PROGRAM****Oral Sessions:**

Sun.–Wed., 9–12 Oct.

**Poster Sessions**

(posters are to be hung all day; authors present a.m. or p.m.):

Sun.–Wed., 9–12 Oct.

**EXHIBIT HALL HOURS**

Sun., 9 Oct., 2–6:30 p.m.

Mon.–Tues., 10–11 Oct.,

9 a.m.–6 p.m.

Wed., 12 Oct., 9 a.m.–2 p.m.

**Lunchtime Lectures:**Sun.–Wed., 9–12 Oct.,  
12:15–1:15 p.m.**Private Alumni Reception:**

Mon., 10 Oct., evening times vary

**Group Alumni Reception:**

Mon., 10 Oct., 7–9:30 p.m.

**Post-Meeting Field Trips:**

Thurs.–Sun., 13–16 Oct.

Annual Meeting  
Schedule Changes

I hope that you are looking forward to our Annual Meeting in Minneapolis, Minnesota, this fall! It promises to be an exciting and exceptionally well-attended meeting.

As vice-president of GSA, I wanted to let you know about a few schedule changes. In recognition of Yom Kippur (7–8 Oct.), some meeting activities usually held on Saturday prior to the start of the Technical Program on Sunday have been rescheduled.

The Presidential Address & Awards Ceremony, always a highlight of our Annual Meeting, has been moved to Sunday, 9 Oct., from 6:30 to 8:30 p.m., to be followed by an Awards and Welcoming Reception from 8:30 to 9:30 p.m.

In order to accommodate these changes, the Exhibit Hall Opening will begin at 2 p.m. on Sunday and will run until 6:30 p.m. Refreshment centers, located in the posters area and Exhibit Hall, will be open from 4:30 to 6:30 p.m.

The Annual Program Committee is to be thanked for their efforts in planning these activities on the first day of our Annual Meeting.

**John Geissman**, *GSA Vice President*

## GSA CONNECTION

*Helps you keep on top of news  
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If you currently aren't receiving the monthly GSA e-newsletter *GSA Connection*, you may be missing out. Sign up for our monthly electronic newsletter, which contains the most recent information for the annual meeting, along with other GSA highlights. Please be assured, we do not sell e-mail addresses or use them for marketing outside of GSA.

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## ▶▶ Call for Papers ◀◀

**Abstract submission deadline:** 26 July 2011

### SUBMITTING AN ABSTRACT

- Upload your abstract at <http://gsa.confex.com/gsa/2011AM/index.epl>.
- A non-refundable fee of US\$35 per abstract submission will be charged to professionals; graduate and undergraduate students will be charged a non-refundable fee of US\$20 per submission.
- Digital posters: The abstract submission fee is US\$80.
- You may present two volunteered abstracts during the Annual Meeting, as long as one of these abstracts is a poster (including digital poster).
- Credit card payment must be made at time of submission or your paper will not be considered for the meeting.
- Abstracts must be 2,000 characters or less, not counting spaces. Do not include title and authors in the abstract.
- Please don't miss the deadline for abstract submission—Tuesday, 26 July 2011.
- Reminder: All speakers and poster presenters must pay the meeting registration fee.

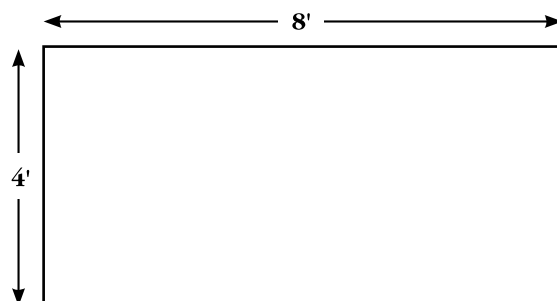
### Oral Presenters

The normal length of an oral presentation is 12 minutes plus three minutes for questions and answers. You *must* visit the Speaker Ready Room at least 24 hours before your scheduled presentation.

### Poster Presentations

GSA will provide one 8-ft wide by 4-ft high freestanding display board and Velcro for hanging the poster. Each poster booth will share a 6-ft by 30-in table, and electricity will be available at no charge. Bring your own extension cord.

Posters will be on display all day, 9 a.m.–6 p.m., with authors present either 9–11 a.m. *or* 2–4 p.m. Authors are also encouraged to be present during the afternoon beer reception from 4:30–6:30 p.m.



### Digital Poster Presentations

GSA will provide a monitor with laptop cable connector; one horizontal, freestanding display board (8-ft wide by 4-ft high); Velcro for hanging your accompanying poster; and electricity. Presenters must provide their own laptops. Each poster booth includes a 6-ft by 30-in table, which will support both the monitor and laptop computer.

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## Discipline Categories

**Can't find a topical session that fits your abstract?** No problem! GSA also offers a variety of discipline sessions, which are equally vital to a robust technical program and essential to the fulfillment of overall meeting goals. Please feel free to contact the JTPC member associated with your discipline regarding the suitability of your abstract for a technical or discipline session.

### 2011 Technical Program Chair

Dave Bush, dbush@westga.edu

### GSA Technical Program Manager

Nancy Wright, nwright@geosociety.org

Review Group	Discipline	Contact(s)
GSA Archaeological Geology Division	archaeological geology	Catherine Yansa, yansa@msn.edu; Kathleen Nicoll, kathleen.nicoll@gmail.com
GSA Coal Geology Division	coal geology	Sue Rimmer, srimmer@geo.siu.edu; Margo D. Corum, mcorum@usgs.gov
GSA Engineering Geology Division	engineering geology	William H. Schulz, wschulz@usgs.gov; Norman S. Levine, levinen@cofc.edu
Environmental Geoscience	environmental geoscience	John F. Bratton, jbratton@usgs.gov
GSA Geobiology & Geomicrobiology Division	geomicrobiology	Stuart Birnbaum, stuart.birnbaum@utsa.edu; Nora Noffke, nnoffke@odu.edu
Geochemical Society	geochemistry; geochemistry, organic	TBD
GSA Geoinformatics Division	geoinformatics	Steve Richard, steve.richard@azgs.az.gov
GSA Geology and Health Division	geology and health	Syed Hasan, hasans@umkc.edu; Robert B. Finkelman, bobf@utdallas.edu
GSA Geology and Society Division	public policy	Karen McCurdy, kmccurdy@GeorgiaSouthern.edu; Joan E. Fryxell, jfryxell@csusb.edu
GSA Geophysics Division	geophysics/tectonophysics/seismology	Audrey D. Huerta, huerta@geology.cwu.edu
GSA Geoscience Education Division; National Assoc. of Geoscience Teachers	geoscience education	Steven H. Schimmrich, schimmrs@sunyulster.edu; Elizabeth Wright, ewright@saic.edu; Sadredin C. Moosavi, smoosavi@charter.net
Geoscience Information Society; Assoc. of Earth Science Editors	geoscience information/communication	Rusty Kimball, rkimball@library.tamu.edu; Monica Easton, monica.easton@ontario.ca
GSA History and Philosophy of Geology Division	history and philosophy of geology	John A. Diemer, jadiemer@unc.edu; Kenneth R. Aalto, kral@humboldt.edu
GSA Hydrogeology Division	hydrogeology	Madeline E. Schreiber, mschreib@vt.edu; Alicia M. Wilson, awilson@geol.sc.edu
GSA Limnogeology Division	limnogeology	Dan Deocampo, deocampo@gsu.edu; Amy Myrbo, amyrb@umn.edu
Marine/Coastal Geology	marine/coastal science	David J.W. Piper, dpiper@nrcan.gc.ca
Mineralogical Society of America	mineralogy/crystallography; petrology, experimental; petrology, igneous; petrology, metamorphic; volcanology	James Beard, jim.beard@vmnh.virginia.gov; Philip Brown, pbrown@geology.wisc.edu
GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division	mineralogy; geochemistry; petrology; volcanology	Russell S. Harmon, russell.harmon@us.army.mil; Calvin G. Barnes, cal.Barne@ttu.edu
Paleoceanography/Paleoclimatology	paleoclimatology/paleoceanography	Sharon Kanfoush, skanfoush@utica.edu
Paleontological Society	paleontology, biogeography/biostratigraphy; paleontology, diversity, extinction, origination; paleontology, paleoecology/taphonomy; paleontology, phylogenetic/morphological patterns	Thomas D. Olszewski, tomo@geo.tamu.edu; Matthew E. Clapham, mclapham@es.ucsc.edu; Caroline A.E. Stromberg, caestrom@u.washington.edu
American Assoc. of Professional Geologists	petroleum geology	TBD
GSA Planetary Geology Division	planetary geology; remote sensing/geographic info system	David Williams, david.williams@asu.edu; Simon Kattenhorn, simkat@uidaho.edu
Precambrian Geology	Precambrian geology	Joe Meert, jmeert@geology.ufl.edu
GSA Quaternary Geology and Geomorphology Division	geomorphology; Quaternary geology	Kyle House, khouse@unr.edu; Jim O'Connor, oconnor@usgs.gov; Sara L. Rathburn, rathburn@cnr.colostate.edu
GSA Sedimentary Geology Division	sediments, carbonates; sediments, clastic; stratigraphy	Brenda Beitler Bowen, bbowen@purdue.edu; Tracy D. Frank, tfrank2@unlnotes.unl.edu
Society of Economic Geologists	economic geology	Harold Noyes, chathl@aol.com; James Saunders, saundja@auburn.edu
GSA Structural Geology and Tectonics Division	neotectonics/paleoseismology; structural geology; tectonics	David P. West, Jr., dwest@middlebury.edu; Phil Resor, presor@wesleyan.edu



# ARCHEAN to ANTHROPOCENE

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## Topical Sessions

**Abstracts deadline:** 26 July 2011



Topical sessions bring together interdisciplinary perspectives and state-of-the-art knowledge to illuminate particular geoscience issues. You are encouraged to submit related research directly to a topical session of your choice.

**T1. Oceanic and Juvenile Continental Crust Formation in the Precambrian:** This session is aimed at examining the Precambrian rock record to better constrain the timing, mode, and nature of geological, geochemical, and geodynamic processes involved in oceanic and juvenile continental crust evolution during the Precambrian.

**Advocates:** Yildirim Dilek, Miami University; Harald Furnes, Bergen, Norway; A. Polat, University of Windsor

**Cosponsors:** GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Structural Geology and Tectonics Division; GSA International Section; Precambrian [At Large]; Geochemical Society; Mineralogical Society of America

**Disciplines:** Precambrian Geology; Geochemistry; Tectonics

**T2. The Ediacaran Period: Tectonic, Climatic, and Biological Enigmas:** The Ediacaran period is the most recent addition to the geological time scale. This session seeks multidisciplinary contributions describing tectonic, climatic, biologic, and oceanic changes during this enigmatic period in Earth's history.

**Advocate:** Mercedes Belica, University of Florida

**Cosponsor:** Precambrian [At Large]

**Disciplines:** Precambrian Geology; Stratigraphy; Paleontology, Diversity, Extinction, Origination

**T3. The Archean of North America: The Core of a Continent:** We will address the 4.0-billion-to 2.5-billion-year-old rocks that make up the core of the North American continent. Younger parts of the continent were built upon this core through tectonic processes.

**Advocates:** M.E. Bickford, Syracuse University; Paul A. Mueller, University of Florida; Joseph L. Wooden, Stanford University

**Cosponsors:** GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Geophysics Division; GSA Structural Geology and Tectonics Division; Mineralogical Society of America; Geological Association of Canada

**Disciplines:** Precambrian Geology; Geochemistry; Petrology, Igneous

**T4. Advancement in the Exploration Practices Used to Characterize Geothermal Resources:** The application of exploration technologies and their results for finding and delineating geothermal resources in various geologic settings.

**Advocate:** Michael B. Hillesheim, National Renewable Energy Laboratory

**Cosponsor:** GSA Geophysics Division

**Disciplines:** Geophysics/Tectonophysics/Seismology; Structural Geology; Geochemistry

**T5. The Lithospheric Anisotropy of Archean Shields:** The Archean lithosphere generally has a strong seismic anisotropy. This session aims to foster collaborative research on the possible crustal and mantle origin(s) of this cratonic anisotropy.

**Advocates:** Eric C. Ferre, Southern Illinois University at Carbondale; Christian Teyssier, University of Minnesota; Nikolas I. Christensen, The University of British Columbia; James A. Conder, Southern Illinois University

**Cosponsors:** GSA Geophysics Division; GSA Structural Geology and Tectonics Division

**Disciplines:** Geophysics/Tectonophysics/Seismology; Tectonics

**T6. Combining Geology and Geophysics:** Contributions of combining geophysics to solve geological problems are encouraged. All fields of geophysics that can be used to solve large-scale tectonic to small-scale environmental/archaeological problems are encouraged.

**Advocates:** Kevin Mickus, Missouri State University; Audrey Huerta, Central Washington University

**Cosponsors:** GSA Geophysics Division; GSA Structural Geology and Tectonics Division

**Disciplines:** Geophysics/Tectonophysics/Seismology

**T7. Exploring Subsurface Terranes and Buried Basins of Eastern and Central North America—Geology, Geophysics, and Geochronology:** Investigations of critical buried terranes, structures, and basins from the coastal plains to the midcontinent provide insights into lithospheric evolution, orogenic cycles, continental accretion and dispersal, structural inheritance, and resources (e.g., energy, minerals, water, CO<sub>2</sub>).

**Advocates:** J. Wright Horton, USGS; Marion E. Bickford, Syracuse University; Paul A. Mueller, University of Florida

**Cosponsors:** GSA Structural Geology and Tectonics Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Geophysics Division; GSA Engineering Geology Division; EarthScope; USGS

**Disciplines:** Tectonics; Geophysics/Tectonophysics/Seismology; Precambrian Geology

**T8. Tectonic Evolution of Eastern Oregon and Western Idaho:** Eastern Oregon and western Idaho exposes a remarkable example of the abrupt juxtaposition of accreted oceanic terranes to the Precambrian North American continent. This interdisciplinary session will investigate the evolution of this continental margin.

**Advocates:** Basil Tikoff, University of Wisconsin–Madison; Richard M. Gaschnig, Washington State University; Todd LaMaskin, University of Wisconsin–Madison; Clyde J. Northrup, Boise State University

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**Cosponsors:** GSA Structural Geology and Tectonics Division;  
GSA Geophysics Division

**Disciplines:** Tectonics; Geophysics/Tectonophysics/  
Seismology; Sediments, Clastic

## T9. Tectonic Development of the Northern North

**American Cordillera:** This cross-disciplinary session will explore tectonic processes that have shaped the northern Cordillera using detrital geochronology, thermochronology, geomorphology, geophysics, modeling, petrology, stratigraphy/sedimentology, and structural geology. Studies from Alaska, western Canada, and the Pacific Northwest are encouraged.

**Advocates:** Jeffrey M. Trop, Bucknell University; Brian A. Hampton, Michigan State University; John I. Garver, Union College

**Cosponsors:** GSA Structural Geology and Tectonics Division;  
GSA Sedimentary Geology Division; GSA Geophysics Division

**Disciplines:** Tectonics; Neotectonics/Paleoseismology;  
Geophysics/Tectonophysics/Seismology

## T10. Toward a Better Understanding of the Uplift History and Mechanisms of the Tibetan Plateau:

This session seeks papers presenting paleoaltimetry, thermochronology, sedimentation accumulation rate, and paleoclimate data from the Tibetan Plateau and its neighboring area. The goal is to clarify formation history and geodynamic mechanisms of the Tibetan Plateau.

**Advocates:** Junsheng Nie, Lanzhou University, China;  
Gregory D. Hoke, Syracuse University

**Cosponsors:** GSA Structural Geology and Tectonics Division;  
GSA Geophysics Division; GSA Sedimentary Geology Division

**Disciplines:** Tectonics; Paleoclimatology/Paleoceanography;  
Sediments, Clastic

## T11. Monazite: The Ultimate Tectonic Record (Posters):

Monazite geochronology has enabled insights ranging from Pleistocene melt-enhanced exhumation in the Himalayas to NeoArchean lower crustal flow in the Canadian Shield. Posters exploring the fascinating links between monazite, tectonics, and continental crust are solicited.

**Advocate:** Gregory Dumond, University of Arkansas

**Cosponsors:** GSA Structural Geology and Tectonics Division;  
GSA Mineralogy, Geochemistry, Petrology, and Volcanology  
Division; Mineralogical Society of America

**Disciplines:** Tectonics; Petrology, Metamorphic; Mineralogy/  
Crystallography

## T12. From Nuna to Rodinia: Proterozoic Growth and Evolution of Laurentia:

This session will highlight recent advances in the understanding of the assembly, growth, stabilization, and modification of Laurentia during the Proterozoic, including tectonic and magmatic accretion, development of orogenic belts, and continental stabilization.

**Advocates:** David Corrigan, Geological Survey of Canada;  
Daniel K. Holm, Kent State University; Sally Pehrsson,  
Geological Survey of Canada; Val W. Chandler, University of

Minnesota—St. Paul; Marion E. Bickford, Syracuse University;  
Kevin L. Mickus, Missouri State University

**Cosponsors:** GSA Structural Geology and Tectonics Division;  
GSA Geophysics Division; GSA Mineralogy, Geochemistry,  
Petrology, and Volcanology Division; Geological Association  
of Canada; Mineralogical Society of America

**Disciplines:** Tectonics; Precambrian Geology; Geophysics/  
Tectonophysics/Seismology

## T13. The Appalachian-Caledonian Clastic Wedges and Their Modern Analog in the Himalayas:

The Himalayan and Appalachian-Caledonian orogens are comparable in scale and tectonic processes. Contributions regarding the clastic sedimentation responses to orogeny in the more ancient, deeply eroded Appalachian-Caledonian system and the modern Himalayas are encouraged.

**Advocates:** Ashraf Uddin, Auburn University; Willis E. Hames, Auburn University; Jack C. Pashin, Geological Survey of Alabama

**Disciplines:** Tectonics; Sediments, Clastic; Geochemistry

## T14. From the Bottom to the Top of the Arabia/Africa-Eurasia Collision: Lithospheric Scale Controls on Upper Crustal Structures and Basins in the Anatolian/Iranian Orogen:

We seek research that sheds light on the lithospheric-scale evolution of the Africa/Arabia-Eurasia collision from new geophysical, structural, and sedimentological datasets from the eastern Mediterranean and Iranian fold-thrust belts.

**Advocates:** Joel E. Saylor, University of Texas at Austin; A. Arda Ozacar, Middle East Technical University, Ankara, Turkey

**Cosponsors:** GSA Structural Geology and Tectonics Division;  
GSA Geophysics Division; GSA Sedimentary Geology Division

**Disciplines:** Tectonics; Sediments, Clastic; Geophysics/  
Tectonophysics/Seismology

## T15. Sedimentary Provenance and Evolution of the Continental Crust: Precambrian to Present:

We seek talks on sedimentary provenance with relevance to crustal evolution, the provenance record of magmatic and arc accretionary processes, and orogenic and cratonal sediment-dispersal pathways.

**Advocate:** Todd LaMaskin, University of Wisconsin—Madison

**Disciplines:** Tectonics; Stratigraphy; Geochemistry

**T16. Linking Modern and Ancient Orogens:** This session welcomes presentations that explore development of ancient orogens through modern parallels and vice versa. Topics might include the geochemical, metamorphic, sedimentary, structural, and/or tectonic development of orogenic belts and their lithotectonic domains.

**Advocates:** Clinton I. Barineau, Columbus State University;  
Christopher S. Holm-Denoma, USGS

**Cosponsors:** GSA Structural Geology and Tectonics Division;  
GSA Mineralogy, Geochemistry, Petrology, and Volcanology  
Division; GSA Geophysics Division; SEPM (Society for  
Sedimentary Geology); GSA Sedimentary Geology Division



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**Disciplines:** Tectonics; Structural Geology; Geophysics/  
Tectonophysics/Seismology

**T17. What, on Earth, Happened at the K-P Boundary?:** From the Coast Range Thrust to the uplifting of the Colorado plateau, this session serves to ask the question: What, on Earth, happened at the Cretaceous-Paleogene Boundary of 65 Ma?

**Advocate:** Paula J. Crook, The University of Texas at Austin

**Disciplines:** Tectonics; Structural Geology; Paleoclimatology/  
Paleoceanography

**T18. Proterozoic to Modern Rifts: Sedimentary and Volcanic Processes and the Role of Inherited Structures:**

Continental rifting is an important tectonic process with many implications for society. The inherited state of the lithosphere greatly controls extensional processes, including sedimentary and volcanic responses to extension. We encourage papers on these topics.

**Advocates:** Melissa A. Lamb, University of St. Thomas; Thomas Hickson, University of St. Thomas; Paul J. Umhoefer, Northern Arizona University

**Cosponsors:** GSA Structural Geology and Tectonics Division; GSA Sedimentary Geology Division

**Disciplines:** Tectonics; Structural Geology; Stratigraphy

**T19. Study on Diagenetic Sealing of Xia 503 Fault in Huimin Sag Bohai Bay Basin, China:** The diageneses that influence the sealing of a fault include filling, compaction, and cementation; because of these, the fault of Xia 503 is a strongly sealed fault and controlled the forming of Jiangjiadian Oilfield.

**Advocate:** Kongyou Wu, College of Geo-Resources and Information, China

**Cosponsor:** China University of Petroleum

**Disciplines:** Structural Geology; Economic Geology; Petrology, Experimental

**T20. Beyond Balanced Sections: New Horizons In Structural and Mechanical Modeling:** This session is focused on numerical modeling techniques that simulate rock structures at many scales. This could include studies of regional structural evolution, fault and fold geometries, fracture development, and gouge properties.

**Advocates:** Gary G. Gray, ExxonMobil Upstream Research Co.; Julia K. Morgan, Rice University

**Cosponsor:** GSA Structural Geology and Tectonics Division

**Disciplines:** Structural Geology; Tectonics; Engineering Geology

**T21. Constraints on Strain Rates, Stresses, and Deformation Processes during Shear Zone Localization at Different Lithospheric Levels:**

This session will provide a venue for new data (field-based, experimental, geophysical, microstructural, etc.) that constrain rock rheology during shear zone localization at different structural levels within the lithosphere.

**Advocates:** Julie Newman, Texas A&M University; David Kohlstedt, University of Minnesota; Basil Tikoff, University of Wisconsin–Madison; Seth C. Kruckenberg, University of Wisconsin–Madison

**Cosponsors:** GSA Structural Geology and Tectonics Division; GSA Geophysics Division

**Disciplines:** Structural Geology; Tectonics; Geophysics/  
Tectonophysics/Seismology

**T22. Deformation of the Lithosphere: Field Observations, Experimental Investigations, and Numerical Studies:**

Experimental deformation and computational tectonics complement field-based investigation by exploring stress, strain, and strain rate through space and time, and the formation and evolution of complex structures at multiple scales and levels in the lithosphere.

**Advocates:** Patrice Rey, University of Sydney; Eric Goergen, Brown University; Seth C. Kruckenberg, University of Wisconsin–Madison

**Cosponsors:** GSA Structural Geology and Tectonics Division; GSA Geophysics Division

**Disciplines:** Structural Geology; Tectonics; Geophysics/  
Tectonophysics/Seismology

**T23. Multidisciplinary Studies of Fault System**

**Deformation:** This session will feature multidisciplinary studies of fault systems over all spatial and temporal scales. We encourage submissions from authors utilizing geology, geophysics, geodesy, geomorphology, modeling, etc., to study the deformation behavior in these systems.

**Advocates:** Eric Horsman, East Carolina University; Sarah Titus, Carleton College

**Cosponsors:** GSA Structural Geology and Tectonics Division; GSA Geophysics Division

**Disciplines:** Structural Geology; Tectonics; Geophysics/  
Tectonophysics/Seismology

**T24. Structural Geology and Tectonics of Foreland**

**Basins:** Many researchers have been studying foreland basins in different orogenic belts. This session will bring these researchers together to provide a formal discussion on important issues related to this topic.

**Advocates:** Ibrahim Çemen, University of Alabama; Jack Pashin, Geological Survey of Alabama; Yucel Yilmaz, Kadir Has University, Turkey

**Cosponsors:** GSA Structural Geology and Tectonics Division; GSA Geophysics Division

**Disciplines:** Structural Geology; Tectonics; Geophysics/  
Tectonophysics/Seismology

**T25. Recent Advances in Studies of Large-Volume Silicic Volcanism: Stratigraphy, Architecture, Evolution:**

Voluminous silicic volcanism is a fundamental type of magmatic activity, though its causes remain enigmatic. This session highlights all aspects of large-volume silicic volcanism, emphasizing studies of volcanic field architecture, eruptive styles, and spatial-temporal evolution.

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**Advocates:** Graham D.M. Andrews, Franklin and Marshall College; Matthew E. Brueseke, Kansas State University; Ben Ellis, Washington State University  
**Cosponsors:** GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Structural Geology and Tectonics Division  
**Disciplines:** Volcanology; Tectonics; Stratigraphy

## T26. **The Occurrence and Growth of Splendid Euhedral Crystals in Different Geological Environments:**

This session focuses on the growth and occurrence of euhedral crystals in various geological environments, such as pegmatite, topaz, rhyolite, hydrothermal, supergene, metamorphic, and igneous.

**Advocate:** Randa R. Harris, University of West Georgia  
**Disciplines:** Mineralogy/Crystallography; Economic Geology; Geochemistry

## T27. **Mystery, Puzzles, Intrigue, Forensic Investigations: The Everyday Life of the Concrete Petrographer:**

This session highlights real-life examples of how concrete petrographers use petrographic tools and techniques to uncover answers to complicated problems that involve anything from the driveway next door to million-dollar law suits and murderous crimes.

**Advocate:** Nancy M. Whiting, Purdue University  
**Cosponsor:** Society of Concrete Petrographers  
**Disciplines:** Mineralogy/Crystallography; Engineering Geology; Petrology, Experimental

## T28. **Basic and Applied Aspects of Clays and Clay Minerals in Continental Settings:**

This session seeks contributions to all aspects of mineralogy, crystallography, and geochemistry of clays and clay minerals in continental settings. This includes weathering, provenance, paleoenvironments, diagenesis, adsorption, surface phenomena, contaminant fate/transport, and engineering geology.

**Advocates:** Daniel Deocampo, Georgia State University; W. Crawford Elliott, Georgia State University  
**Cosponsors:** GSA Limnogeology Division; Clay Minerals Society; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Engineering Geology Division  
**Disciplines:** Mineralogy/Crystallography; Geochemistry

## T29. **Microbial Mediation of Authigenic Minerals: From Precipitation to Dissolution:**

This interdisciplinary session examines the role of microbes in mediating the precipitation, dissolution, or alteration of authigenic minerals, such as carbonates, phosphorites, iron deposits, sulfides, and more.

**Advocate:** Jake V. Bailey, University of Minnesota–Twin Cities  
**Cosponsor:** GSA Geobiology & Geomicrobiology Division  
**Disciplines:** Mineralogy/Crystallography; Geochemistry

T30. **Earth's Deep Interior:** This session aims to bring together studies of the mineralogy, petrology, dynamics, geochemistry, and seismology of Earth's mantle, core, and the core-mantle boundary region.

**Advocate:** Jay D. Bass, University of Illinois–Urbana-Champaign  
**Cosponsors:** Mineralogical Society of America; GSA Geophysics Division  
**Disciplines:** Mineralogy/Crystallography; Geophysics/Tectonophysics/Seismology; Petrology, Experimental

T31. **Monazite: The Ultimate Geologic Record:** Monazite geochronology has enabled diverse insights ranging from identification of Pleistocene melt-enhanced exhumation in the Himalayas to advances in nuclear waste storage. All field, analytical, experimental, and modeling aspects of monazite science are solicited.

**Advocates:** Gregory Dumond, University of Arkansas; Callum J. Hetherington, Texas Tech University  
**Cosponsors:** GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Structural Geology and Tectonics Division; Mineralogical Society of America  
**Disciplines:** Mineralogy/Crystallography; Petrology, Metamorphic; Tectonics

## T32. **Ophiolites, Ultrahigh Pressure Minerals, and the Origin of Podiform Chromitites: Implications for Mantle Heterogeneity:**

This session will explore the occurrence of UHP and crustal minerals in ophiolitic rocks and their significance for mantle conditions and processes.

**Advocates:** Jingsui Yang, Chinese Academy of Geological Sciences, Beijing, China; Paul T. Robinson, Dalhousie University  
**Cosponsors:** Mineralogical Society of America; International Section of the Geological Society of America  
**Disciplines:** Petrology, Igneous; Mineralogy/Crystallography; Geochemistry

## T33. **Reconstructing Supercontinents and the Global Large Igneous Province (LIP) Record:**

Quantitative reconstruction of ancient supercontinents requires precise geochronological and paleomagnetic data, which we encourage for presentation. We will also feature results from a five-year global project to produce “magmatic barcodes” for all major continental blocks.

**Advocates:** David A.D. Evans, Yale University; Kevin R. Chamberlain, University of Wyoming; Richard E. Ernst, University of Ottawa; Wouter Bleeker, Geological Survey of Canada  
**Disciplines:** Petrology, Igneous; Tectonics; Precambrian Geology

## T34. **Ultrahigh-Pressure Metamorphism: Observations from Nano through Outcrop to Plate-Tectonic Scales: In Honor of J.G. Liou:**

Newly formed ultrahigh-pressure minerals and nano-phases document the *P-T*-time paths of profoundly subducted but now resurrected allochthons, revealing the architectures, kinetics, and tectonic evolutions of many collisional orogens in this rapidly growing field of petrotectonics.



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**Advocates:** Bradley R. Hacker, University of California at Santa Barbara; Larissa Dobrzhinetskaya, Riverside, Calif.; Suzanne L. Baldwin, Syracuse University

**Cosponsor:** Mineralogical Society of America

**Disciplines:** Petrology, Metamorphic; Mineralogy/Crystallography; Tectonics

**T35. Turning up the Heat: Metamorphic Perspectives on Mineral Equilibria, Heat Transport, Tectonics, and Thermochronology:** Many advances in metamorphic petrology integrate thermal and metamorphic histories. This session encourages contributions that link these topics to kinetic, reaction, tectonic, and other physico-chemical processes.

**Advocates:** Emily M. Peterman, Stanford University; Matthew J. Kohn, Boise State University

**Cosponsors:** GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Structural Geology and Tectonics Division; Mineralogical Society of America

**Disciplines:** Petrology, Metamorphic; Tectonics; Geochemistry

**T36. Comprehensive Data Sets for the Reconstruction of Geological Histories: Combining Double and Triple Dating with Geochemical Fingerprinting:** This session is aimed at studies combining different thermo- and geochronometers and/or geochemical fingerprinting to provide more comprehensive insights into geological, stratigraphic, tectonic, and petrological processes. Methodological and case studies and conceptual models are welcome.

**Advocates:** Andreas Möller, University of Kansas; Daniel F. Stockli, University of Kansas

**Disciplines:** Petrology, Metamorphic; Tectonics; Petrology, Igneous

**T37. New Frontiers in Sedimentary Geology: SGD**

**Students (Posters):** This is an annual session sponsored by the GSA Sedimentary Geology Division (SGD) to promote research and presentations by young sedimentary scientists.

**Advocate:** Richard P. Langford, University of Texas at El Paso

**Cosponsors:** GSA Sedimentary Geology Division; SEPM (Society for Sedimentary Geology)

**Disciplines:** Sediments, Carbonates; Sediments, Clastic; Stratigraphy

**T38. Provenance Analysis in Modern and Ancient**

**Sedimentary Systems:** This session will provide a forum for discussing recent advances in determining provenance in siliciclastic sediments and sedimentary rocks from weathering processes to compositional changes from transport and diagenesis to detrital zircon studies.

**Advocates:** Christopher M. Fedo, University of Tennessee; Michael C. Pope, Texas A&M University

**Cosponsor:** GSA Sedimentary Geology Division

**Disciplines:** Sediments, Clastic; Geochemistry

**T39. Integrated Sedimentary Systems: Applying Source-to-Sink Concepts across Geologic Time:** This session aims to integrate the earth-science disciplines of stratigraphy, sedimentology, geomorphology, tectonics, basin analysis, and isotope geology to reconstruct holistic sedimentary systems in modern and ancient contexts.

**Advocates:** Andrea Fildani, Chevron ETC; Jacob A. Covault, USGS

**Cosponsors:** GSA Sedimentary Geology Division; GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Sediments, Clastic; Geomorphology; Stratigraphy

**T40. Thresholds and Pathways of River Avulsion:** Despite recent advances in our understanding of channel avulsion, it remains difficult to predict and model when, where, and how channels will avulse. This session brings together stratigraphers, geomorphologists, experimentalists, and modelers studying avulsion dynamics.

**Advocates:** Elizabeth Hajek, Penn State University; Douglas Edmonds, Boston College

**Cosponsors:** GSA Sedimentary Geology Division; GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Sediments, Clastic; Geomorphology; Stratigraphy

**T41. Paying Attention to Mudstones: Priceless!** Much remains unknown about mudstones though they contain vast natural resources, provide critical clues to paleoenvironmental/paleoecological conditions surrounding their deposition, and record post-depositional alterations they endured. New, exciting mudstone research will be the focus of this session.

**Advocates:** Neil Fishman, Denver, Colo.; Sven Egenhoff, Colorado State University

**Cosponsors:** GSA Sedimentary Geology Division; GSA Limnogeology Division

**Disciplines:** Sediments, Clastic; Paleoclimatology/Paleoceanography; Limnogeology

**T42. Sediment Transport in Modern and Ancient**

**Environments:** This session seeks to showcase current state-of-the-art in-process sedimentology and to facilitate the next step in understanding sediment transport across the entire range of modern environments and their relationships to ancient successions.

**Advocates:** Brandon McElroy, Columbia Environmental Research Center; Wonsuck Kim, The University of Texas at Austin

**Cosponsors:** GSA Sedimentary Geology Division; GSA Quaternary Geology and Geomorphology Division; GSA Engineering Geology Division

**Disciplines:** Sediments, Clastic; Sediments, Carbonates; Geomorphology

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**T43. Prediction in Stratigraphy:** This session will focus on stratigraphic prediction including (1) methods of prediction; (2) limits and accuracy of stratigraphic prediction; (3) examples of stratigraphic prediction; and (4) methods of testing.

**Advocates:** Christopher Paola, University of Minnesota–Twin Cities; Paul L. Heller, University of Wyoming

**Cosponsors:** GSA Sedimentary Geology Division; SEPM (Society for Sedimentary Geology); National Center for Earth-Surface Dynamics

**Disciplines:** Sediments, Clastic; Stratigraphy; Sediments, Carbonates

**T44. Quantitative Provenance in Sediment Genesis via Various Analytical Techniques; a Necessary Multidisciplinary Step toward a Source-to-Sink Model: Pathway for Basin Analysis Interpretations:**

This session will help determine the state of the art and perspectives in quantitative provenance analysis (sedimentary geology) by quantifying the factors controlling composition of sedimentary siliciclastic rocks, production, and development (source; pre-diagenesis) to its further sink (pre-metamorphism).

**Advocates:** Igor Ishi Rubio-Cisneros, Universidad Autónoma de Nuevo León, México; Yam Zul Ernesto Ocampo-Díaz, Universidad Autónoma de Nuevo León, México

**Cosponsors:** GSA Sedimentary Geology Division; PEMEX/PEP; ExxonMobil/Upstream Research Company; CoreLabs; Leica; Petzl; REI; Outdoor Industry Association; Salewa; Alta Vertical; VERTIMANIA

**Disciplines:** Sediments, Clastic; Stratigraphy; Tectonics

**T45. Formation, Development, and Preservation of Bed Morphologies:**

This session encourages geoscientists working on bedforms from a wide range of disciplines to submit abstracts. Understanding their formation and development as well as their preservation is crucial for building more comprehensive depositional models.

**Advocates:** Mauricio M. Perillo, University of Illinois–Urbana-Champaign; Paul M. Myrow, Colorado College

**Cosponsors:** GSA Sedimentary Geology Division; SEPM (Society for Sedimentary Geology); International Association of Sedimentologists

**Disciplines:** Sediments, Clastic; Stratigraphy

**T46. Application of New Stratigraphic Tools to Precambrian and Igneous Rocks: Challenges and Solutions:**

This session provides a forum for discussing the application of GSSPs in the Precambrian, as well as formal and informal approaches to Precambrian stratigraphy, including the utilization of chemo- and isotopic stratigraphy and lithogenic units.

**Advocates:** Robert Michael Easton, Ontario Geological Survey; Rob Rainbird, Natural Resources Canada

**Cosponsors:** Precambrian [At Large]; North American Commission on Stratigraphic Nomenclature; ICS Subcommission on Precambrian Stratigraphy; International Subcommission on Stratigraphic Classification; SEPM (Society for Sedimentary Geology)

**Disciplines:** Stratigraphy; Precambrian Geology; History and Philosophy of Geology

**T47. Coalbed Natural Gas: Characterization of Source, Reservoir Performance, and Environmental Impacts:**

This session examines advances in the study of coalbed natural gas. Topics include controls on gas generation and sorption, quality and impact of co-produced waters, and the implications of CO<sub>2</sub> sequestration in coal.

**Advocates:** Mark A. Engle, USGS; Jack C. Pashin, Geological Survey of Alabama

**Cosponsor:** GSA Coal Geology Division

**Disciplines:** Coal Geology; Environmental Geoscience; Hydrogeology

**T48. Frontiers in Coal Science: From Basic Research to Applied Technology:**

This session highlights recent advances in coal science. Topics include environmental effects of coal utilization, characterization of coal combustion products, coal gasification/liquefaction, economics of coal use, carbon sequestration, coal petrology, and sedimentology.

**Advocates:** Kevin B. Jones, USGS; Margo D. Corum, USGS

**Cosponsor:** GSA Coal Geology Division

**Disciplines:** Coal Geology; Geology and Health; Environmental Geoscience

**T49. The Context and Constraints of Continental-Scale Coal Deposition: Climate, Geochemistry, Sedimentology, and Stratigraphy:**

Talks will cover recent research on the conditions, depositional settings, constraining factors, and even implications of continental-scale coal deposits and associated sediments.

**Advocates:** Scott D. Elrick, Illinois State Geological Survey; Susan M. Rimmer, Southern Illinois University–Carbondale

**Cosponsor:** GSA Coal Geology Division

**Disciplines:** Coal Geology; Stratigraphy; Geochemistry

**T50. Applications of Bio- and Chemostratigraphy to Sequence Stratigraphy:**

We encourage papers applying biostratigraphic, chemostratigraphic, quantitative mineralogic, and inorganic elemental optimization techniques to sequence stratigraphy (MFS/SB). Integrative studies contextualize outcrop and well data to global cyclicity encompassing Milankovitch and global sea-level cycles.

**Advocates:** Alicia C.M. Kahn, Chevron Corp.; Douglas McCarty, Chevron Corp; Miriam E. Katz, Rensselaer Polytechnic Institute

**Cosponsors:** Paleontological Society; GSA Sedimentary Geology Division

**Disciplines:** Paleontology, Biogeography/Biostratigraphy; Geochemistry; Stratigraphy

**T51. Phanerozoic Palynology: Applications to Stratigraphic, Paleoenvironmental, and Paleoclimatic Research:**

This session focuses on studies of Cambrian to Holocene sedimentary sequences, which use palynology as a

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proxy for biostratigraphy, paleoecology, paleoenvironmental reconstruction, and paleoclimatology.

**Advocates:** Francisca E. Oboh-Ikuenobe, Missouri University of Science and Technology; Lanny H. Fisk, PaleoResource Consultants; Debra A. Willard, USGS

**Cosponsors:** AASP - The Palynological Society; Paleontological Society

**Disciplines:** Paleontology, Biogeography/Biostratigraphy; Paleontology, Paleoecology/Taphonomy; Paleoclimatology/Paleoceanography

**T52. Species and Speciation in the Fossil Record:** This session will bring together specialists across taxa and geological ages to explore the meaning and role of species in paleontology. Can paleontologists contribute to understanding of speciation? If so, how and under what circumstances?

**Advocates:** Warren D. Allmon, Paleontological Research Institution; Margaret M. Yacobucci, Bowling Green State University

**Cosponsors:** Paleontological Society; Society of Vertebrate Paleontology; Cushman Foundation; Paleontological Research Institution

**Disciplines:** Paleontology, Diversity, Extinction, Origination; Paleontology, Biogeography/Biostratigraphy; Paleontology, Phylogenetic/Morphological Patterns

**T53. The Triassic: Turning Point for Phanerozoic Life:** This session will integrate paleoecological, evolutionary, and environmental studies toward generating a new interdisciplinary framework for understanding the Triassic Earth system and why it was a turning point for Phanerozoic life.

**Advocate:** David J. Bottjer, University of Southern California at Los Angeles

**Cosponsors:** Paleontological Society; GSA Geobiology & Geomicrobiology Division

**Disciplines:** Paleontology, Diversity, Extinction, Origination; Paleontology, Paleoecology/Taphonomy; Geochemistry

**T54. Multidisciplinary Approaches to Studying the Causes and Consequences of Mass Extinction:**

**Geochemistry, Paleoecology, and Paleoenvironments:**

This session aims to integrate paleontological, geochemical, and sedimentological studies spanning intervals of mass extinction in order to showcase new and multidisciplinary approaches to determining cause and effect during these critical intervals.

**Advocates:** Marc Laflamme, Smithsonian Museum of Natural History; Simon A.F. Darroch, Yale University

**Cosponsor:** Paleontological Society

**Disciplines:** Paleontology, Diversity, Extinction, Origination; Paleontology, Paleoecology/Taphonomy; Paleontology, Biogeography/Biostratigraphy

**T55. New Horizons in Precambrian Palynology and Paleobiology:**

We explore new findings in Precambrian palynology and their bearing on such questions as deep branching in the phylogeny of eukaryote lineages, trophic

reconstruction of Precambrian ecosystems, and comparison of carbonate and siliciclastic microbial assemblages.

**Advocate:** Paul K. Strother, Boston College

**Cosponsors:** GSA Geobiology & Geomicrobiology Division; AASP - The Palynological Society; Paleontological Society

**Disciplines:** Paleontology, Diversity, Extinction, Origination; Paleontology, Phylogenetic/Morphological Patterns; Precambrian Geology

**T56. From Organic Detritus to Coal: Tracing the Terrestrial Decomposer Community in Permineralized Peat, Lignite, and Coal:**

We will evaluate processes and rates of terrestrial decomposition recorded in permineralized peat and coal and investigate ways to link the paleoecological record of terrestrial decomposition in permineralized peat and coal.

**Advocates:** Jen O'Keefe, Morehead State University; Anne Raymond, Texas A&M University

**Cosponsors:** Paleontological Society; GSA Coal Geology Division; AASP - The Palynological Society; GSA Geobiology & Geomicrobiology Division

**Disciplines:** Paleontology, Paleoecology/Taphonomy; Coal Geology; Geomicrobiology

**T57. Hard Substrate (Sclerobiont) Community Ecology and Evolution through Mass Extinctions:**

Investigating the magnitude and nature of changes affecting encrusting, boring, and grazing organisms on shells, reefs, and other hard surfaces through mass extinctions, at scales ranging from short-term and local to long-term and global.

**Advocates:** Paul D. Taylor, Natural History Museum—London; Mark Wilson, College of Wooster

**Cosponsor:** Paleontological Society

**Disciplines:** Paleontology, Paleoecology/Taphonomy; Paleontology, Diversity, Extinction, Origination; Paleontology, Phylogenetic/Morphological Patterns

**T58. Whole Organism Paleoecology: Exploring Ecology through Time:**

While modern systems provide analogues for past systems, ancient ecosystems offer a temporal perspective well suited to studying changes through time, interpreting modern phenomena, and creating predictive models for the future.

**Advocates:** Amelinda E. Webb, Yale University; William Ausich, Ohio State University

**Cosponsors:** Paleontological Society; GSA Geobiology & Geomicrobiology Division

**Disciplines:** Paleontology, Paleoecology/Taphonomy; Paleontology, Diversity, Extinction, Origination; Paleontology, Phylogenetic/Morphological Patterns

**T59. New Ideas on Studying Exceptionally Preserved Fossils: What to Do Next?:**

Many classic deposits of exceptional preservation have been studied and restudied for decades. As young investigators, what can we do to bring a new level of paleontological, ecological, and taphonomical meanings about these exquisite fossils?



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**Advocates:** Jih-Pai Lin, Nanjing Institute of Geology and Palaeontology, China; Alison Olcott Marshall, University of Kansas; Craig P. Marshall, University of Kansas

**Cosponsors:** GSA Geobiology & Geomicrobiology Division; Chinese Academy of Sciences; State Key Laboratory of Palaeobiology and Stratigraphy; Nanjing Institute of Geology and Palaeontology

**Disciplines:** Paleontology, Paleoecology/Taphonomy; Paleontology, Diversity, Extinction, Origination

## T60. **Lessons from the Living: Paleontological**

**Investigations Using Modern Analogs:** This session will cover a broad range of experimental research involving modern organisms and its application to paleontological problems. Topics include paleoecology, organism-substrate interactions, microbial activity, taphonomy, morphology, behavior, physiology, functional morphology, biomechanics, and kinematics.

**Advocates:** Daniel I. Hembree, Ohio University; Jon J. Smith, Kansas Geological Survey; Brian F. Platt, University of Kansas

**Cosponsor:** Paleontological Society

**Disciplines:** Paleontology, Paleoecology/Taphonomy; Paleontology, Phylogenetic/Morphological Patterns; Geomicrobiology

## T61. **Phylogenetic Approaches to Paleobiology:**

**Diversity, Rates, and Trends:** This session will focus on research that uses phylogenies of fossil taxa as the basic data with which to test evolutionary hypotheses and reconstruct historical patterns of change.

**Advocates:** David W. Bapst, University of Chicago; Emily A. King, University of Chicago

**Cosponsor:** Paleontological Society

**Disciplines:** Paleontology, Phylogenetic/Morphological Patterns; Paleontology, Diversity, Extinction, Origination; Paleontology, Biogeography/Biostratigraphy

## T62. **Frontiers in Foraminiferal Research: Implications for Interpreting the Past, Understanding the Present, and Predicting the Future:**

Foraminiferal research is taking quantum leaps in diverse directions, including shell chemistry and structure, dispersal mechanisms, and eukaryotic physiology and evolution. We seek participation by investigators developing new techniques and pursuing implications of recent breakthroughs.

**Advocates:** Pamela Hallock, University of South Florida; Susan T. Goldstein, Athens, Ga.

**Cosponsors:** Cushman Foundation for Foraminiferal Research; SEPM (Society for Sedimentary Geology); North American Micropaleontology Section SEPM; Paleontological Society; GSA Geobiology & Geomicrobiology Division

**Disciplines:** Paleontology, Phylogenetic/Morphological Patterns; Paleontology, Paleoecology/Taphonomy; Marine/Coastal Science

## T63. **Permian-Triassic Changes and Extinction Event: New Insights from Sedimentary, Geochemical, and Paleobiological Records and Modeling Approaches:**

Presentations of marine and land sedimentary, geochemical, paleobiological, and paleogeographical records examining causes of the largest mass extinction event of the Phanerozoic Eon are welcome. Approaches of interest include new data, modeling, and/or synthesis.

**Advocates:** Arne M.E. Winguth, The University of Texas at Arlington; Thomas J. Algeo, University of Cincinnati

**Cosponsors:** GSA Sedimentary Geology Division; GSA Geobiology & Geomicrobiology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

**Disciplines:** Paleoclimatology/Paleoceanography; Geochemistry; Paleontology, Diversity, Extinction, Origination

**T64. Soils as Archives of Past Climates:** We seek contributions from all fields of the earth sciences that investigate the links between soil properties and climate or use soils to reconstruct past climates.

**Advocates:** Christoph Geiss, Trinity College; Edward Nater, University of Minnesota–Saint Paul

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Paleoclimatology/Paleoceanography; Geophysics/Tectonophysics/Seismology; Quaternary Geology

## T65. **Paleoclimate, Terrestrial Ecosystems, and Human Evolution in Africa from the Pleistocene to the Present:**

This session examines linkages among Pleistocene to present paleoclimate, terrestrial ecosystems, and human evolution across Africa using marine, lacustrine, and terrestrial records. This includes approaches involving modern processes, diverse geological disciplines, archaeology, paleoanthropology, and paleobiology.

**Advocates:** Daniel J. Peppe, Baylor University; David L. Fox, University of Minnesota; Christian Tryon, New York University

**Cosponsors:** GSA Archaeological Geology Division; GSA Limnogeology Division

**Disciplines:** Paleoclimatology/Paleoceanography; Paleontology, Biogeography/Biostratigraphy; Archaeological Geology

## T66. **Advances in Terrestrial Paleoclimatology and Paleoecology: Geochemical Techniques and Examples Using Inorganic and Organic Molecules in Fossil Soils, Plants, Invertebrates, and Vertebrates:**

A growing number of elemental, isotope, and molecular proxies are being used to understand terrestrial paleoecology and paleoclimatology. We encourage submissions that employ these tools for understanding ancient terrestrial ecosystems throughout Earth's history.

**Advocates:** Celina Suarez, Boise State University; Samuel Matson, Boise State University; Aisha Al-Suwaidi, Oxford University; Patrick Wheatley, Lawrence Berkeley National Lab

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**Cosponsors:** GSA Geobiology & Geomicrobiology Division; Paleontological Society; Geochemical Society; GSA Archaeological Geology Division

**Disciplines:** Paleoclimatology/Paleoceanography; Paleontology, Paleoecology/Taphonomy; Geochemistry

**T67. Landslides and Debris Flows: Understanding Past, Present, and Future Events:** This session will explore our understanding of past and present landslides and debris flows and our predictive capability for future events. We encourage contributions addressing problems associated with any type of landslide or debris flow.

**Advocates:** Dennis M. Staley, USGS; William H. Schulz, USGS

**Cosponsors:** GSA Engineering Geology Division; GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Geomorphology; Engineering Geology; Quaternary Geology

## **T68. Water and Sediment Dynamics in Agricultural Landscapes: Toward Prediction of Watershed Sediment Yield (Posters):**

This session brings together a diverse group of geographers, geomorphologists, hydrologists, soil scientists, and agricultural scientists to evaluate approaches for predicting water and sediment yield in agricultural landscapes.

**Advocates:** Patrick Belmont, Utah State University; Karen B. Gran, University of Minnesota–Duluth; Carrie E. Jennings, University of Minnesota–St. Paul

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; GSA Engineering Geology Division; GSA Hydrogeology Division; GSA Geology and Society Division; GSA Geophysics Division; GSA Geoinformatics Division; Soil Science Society of America

**Disciplines:** Geomorphology; Environmental Geoscience; Engineering Geology

## **T69. Fluvial Biogeomorphology: The Interconnection of Biological and Geomorphological Processes in Rivers:**

This session will bring together interdisciplinary researchers who focus on the interaction between biological and geomorphological processes in rivers, including invasive and endangered species, water quality and quantity issues, and other biogeomorphological research.

**Advocates:** Joshua C. Galster, Montclair State University; Dirk Vanderklein, Montclair State University

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; GSA Geobiology & Geomicrobiology Division

**Disciplines:** Geomorphology; Geomicrobiology; Environmental Geoscience

## **T70. Mineralogy, Geochemistry, and Physical Properties of Atmospheric Mineral Dust: Influences on the Atmosphere, the Cryosphere, Ecosystems, and Humans:**

This session emphasizes the mineralogy, geochemistry, and physical properties of contemporary dust to understand the influences of atmospheric particulate matter on climate,

weather, snow- and ice-melt, human health, landscape fertility, and ocean fertilization.

**Advocates:** Richard L. Reynolds, USGS; Joshua Feinberg, University of Minnesota; Suzette A. Morman, USGS

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; The Mineralogical Society

**Disciplines:** Geomorphology; Mineralogy/Crystallography; Geology and Health

## **T71. The Genesis and Fate of Legacy Terrestrial Organic Carbon:**

Sedimentary deposits amassed downstream and downslope of agricultural lands contain the bulk of pre-settlement soil carbon. These deposits are either an inert carbon sink or a remineralizable carbon source. This session explores this debate.

**Advocates:** Jane Willenbring, University of Pennsylvania; Brandon McElroy, Columbia Environmental Research Center

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; GSA Archaeological Geology Division; GSA Geology and Society Division; GSA Geobiology & Geomicrobiology Division

**Disciplines:** Geomorphology; Quaternary Geology; Geochemistry

## **T72. Defining Rates of Landscape Evolution in Drylands Using Numerical Dating Methods:**

We encourage submissions dealing with chronological methods applied to dryland geomorphology—both the novel application of existing methods and techniques specifically developed to address particular problems, including the relationship with the role of tectonics.

**Advocates:** Edward J. Rhodes, University of California at Los Angeles; Lewis Owen, University of Cincinnati

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Geomorphology; Quaternary Geology; Neotectonics/Paleoseismology

## **T73. Quaternary Landscape Dynamics Beyond the Ice Margin in the Upper Mississippi Valley: A Tribute to the Career of James C. Knox:**

This session will focus on Pleistocene and Holocene environmental change and geomorphic system response in the Upper Mississippi basin outside the limits of late Wisconsin glaciation.

**Advocates:** Joseph A. Mason, University of Wisconsin–Madison; Douglas J. Faulkner, University of Wisconsin–Eau Claire; Peter M. Jacobs, University of Wisconsin–Whitewater

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Geomorphology; Quaternary Geology; Paleoclimatology/Paleoceanography

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## T74. Processes of Subglacial Erosion, Sediment

**Transport, and Deposition:** This session will highlight processes of subglacial erosion, sediment transport, and deposition through research on modern glaciers and glacial landforms and sediments, as well as through experimental and theoretical studies.

**Advocates:** Neal Iverson, Iowa State University; Scott Lundstrom, Geology and Environmental Change Science Center, Denver, Colo.; Thomas Hooyer, University of Wisconsin–Milwaukee; Kelly MacGregor, Macalester College

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Geomorphology; Quaternary Geology; Remote Sensing/Geographic Info System

## T75. From Flumes to Field: How Can We Best Learn from Small Data Sets and Small-Scale Experiments to Study Surface Processes?:

Limited data sets and small-scale experiments are commonly used to understand larger systems when studying surface processes. This session will explore ways to effectively use scaling methods to apply these to complex field-scale systems.

**Advocates:** Stephanie S. Day, University of Minnesota–Twin Cities; Sarah Baumgardner, University of Minnesota; Antoinette Abeyta, University of Minnesota

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; National Center for Earth-Surface Dynamics; GSA Engineering Geology Division

**Disciplines:** Geomorphology; Sediments, Clastic; Quaternary Geology

## T76. A Multidisciplinary Approach to Understanding the Dynamics of Sinuous Channel Evolution in Different Environments:

This session welcomes contributions focusing on numerical modeling, physical experimentation, field-based studies, and analysis of remotely sensed data to solve problems related to modern and ancient sinuous channel systems on Earth and other planets.

**Advocates:** Anjali M. Fernandes, The University of Texas at Austin; Virginia B. Smith, The University of Texas at Austin

**Cosponsors:** GSA Sedimentary Geology Division; National Center of Earth Surface Dynamics; GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Geomorphology; Sediments, Clastic; Stratigraphy

## T77. Karst Waters and Culture: Exploring How Karst Water and the Dissolution Landscape Have Impacted Human History and Civilization:

The profound interaction between karst hydrogeology and humans will be explored. Possible topics may include water supply, other resources (salt peter, caves), land use, archaeology (Neolithic, classical, pre-Columbian), hydromythology, architecture, and military geology.

**Advocates:** Dorothy J. Vesper, West Virginia University; William K. Jones, Karst Waters Institute

**Cosponsors:** GSA Hydrogeology Division; Karst Waters Institute; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Archaeological Geology

## T78. Mine Reclamation Researches versus Practices in Emerging World Economy (Posters):

Research and practices on mine tailing and acid mine drainage in the developed and emerging world economic countries—past, current, and future—will be the focus of this poster session.

**Advocates:** Zhaohui Li, University of Wisconsin–Parkside; Minglu Li, Ministry of Land and Resources, Beijing, China

**Cosponsor:** GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Economic Geology; Engineering Geology

## T79. Analytic Modeling of Groundwater Flow: Advances and Applications:

We seek presentations about the use of analytic solutions to groundwater flow or subsurface contaminant transport, including advances or applications in the analytic element method (AEM) or LT-AEM and other analytic solutions to flow or transport problems.

**Advocate:** Randal Barnes, University of Minnesota

**Cosponsors:** GSA Hydrogeology Division; Minnesota Ground Water Association; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Environmental Geoscience; Engineering Geology

## T80. Environmental Problems in Karst Terranes/Terrains and Their Solutions: In Honor of James F. Quinlan:

This session on applied karst hydrology and geology is held in honor of the late Dr. James Quinlan, one of the founders of modern karst research in the United States.

**Advocates:** E. Calvin Alexander, University of Minnesota; Geary M. Schindel, Edwards Aquifer Authority

**Cosponsors:** GSA Hydrogeology Division; GSA Engineering Geology Division; GSA Quaternary Geology and Geomorphology Division; Edwards Aquifer Authority; National Cave and Karst Research Institute; Karst Waters Institute; Minnesota Ground Water Association

**Disciplines:** Hydrogeology; Environmental Geoscience; Engineering Geology

## T81. Springs as Sites of Dynamic Physical, Geochemical, and Ecological Processes:

Springs can be used to study many geological and ecological problems and processes. We encourage submissions highlighting the use of springs to better understand aquifer properties, geochemical processes, landscape or ecosystem evolution, and/or climate change.

**Advocates:** Sue Swanson, Beloit College; Abe Springer, Northern Arizona University

**Cosponsor:** GSA Hydrogeology Division

**Disciplines:** Hydrogeology; Environmental Geoscience; Geochemistry

## T82. Impact of Winter De-Icing Chemicals on the Environment:

Winter de-icing chemicals on their return path from road surfaces create many environmental problems



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including deterioration of public water supplies, interference with aquatic life environments, and infrastructure corrosion.

**Advocates:** Rudolph Hon, Boston College; Walton R. Kelly, University of Illinois–Champaign; Samuel V. Panno, Illinois State Geological Survey

**Cosponsor:** GSA Hydrogeology Division

**Disciplines:** Hydrogeology; Environmental Geoscience; Geology and Health

## T83. **Pathogens and Fecal Indicators in Soil,**

**Groundwater, and Surface Water:** This session examines fecal contamination from a variety of perspectives, including detection, transport, survival, modeling, regulation, and management. We are especially interested in field-scale studies and cross-disciplinary research.

**Advocates:** Larry D. McKay, University of Tennessee; Mark Borchardt, USDA Agricultural Research Service

**Cosponsor:** GSA Hydrogeology Division

**Disciplines:** Hydrogeology; Environmental Geoscience; Geology and Health

## T84. **Recent Advances in Studies of Dissolved Arsenic and Other Metals in Global Hydrologic Systems:**

The session will focus on studies of hydrological, chemical, and biogeochemical processes controlling the fate of dissolved arsenic and other toxic metals. Effects on public health and water management are also of interest.

**Advocates:** Prosun Bhattacharya, Royal Institute of Technology (KTH), Sweden; Abhijit Mukherjee, Indian Institute of Technology (IIT), India; D. Kirk Nordstrom, Boulder Labs; Holly A. Michael, University of Delaware; Jochen Bundschuh, National Cheng Kung University, Taiwan

**Cosponsors:** GSA Hydrogeology Division; GSA Geology and Health Division; GSA International Section; International Society of Groundwater for Sustainable Development

**Disciplines:** Hydrogeology; Environmental Geoscience; Geology and Health

T85. **Dynamic Gradients in Karst Aquifers:** This session highlights approaches for understanding karst aquifer function in the face of dynamic gradients in head, chemistry, and temperature. Studies that provide a geologic context within which dynamic gradients may be interpreted are sought.

**Advocates:** Daniel H. Doctor, USGS; E. Calvin Alexander, University of Minnesota

**Cosponsors:** GSA Hydrogeology Division; National Cave and Karst Research Institute; Karst Waters Institute; Minnesota Ground Water Association

**Disciplines:** Hydrogeology; Environmental Geoscience; Geomorphology

## T86. **Groundwater–Surface Water Interaction: Relating Understanding That Spans the Water-Rich Midwest to the Scarcity of the Outback:**

This session highlights the understanding of groundwater–surface water interaction transferable across temporal and spatial scales, as well as

end-members of climate forcing. The focus is on broad concepts transferable to settings critical for decision making.

**Advocates:** Peter G. Cook, Glen Osmond SA, Australia; Randall Hunt, USGS

**Cosponsors:** GSA Hydrogeology Division; GSA Geology and Health Division; GSA Geology and Society Division; U.S. National Chapter of International Association of the Hydrogeologists; Wisconsin Section, AWRA; Minnesota Ground Water Association; Australian National Centre for Groundwater Research and Training; GSA Limnogeology Division

**Disciplines:** Hydrogeology; Environmental Geoscience; Limnogeology

## T87. **Groundwater and Ecosystem Coupling in Glacial**

**Environ:** The session will examine the role that groundwater plays in sustaining ecosystem habitat or function in glacial systems. Groundwater availability and sustainability and their relation to ecosystems will be examined.

**Advocates:** Rodney A. Sheets, USGS; Randall Hunt, USGS; Howard W. Reeves, USGS

**Cosponsors:** GSA Hydrogeology Division; GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Hydrogeology; Environmental Geoscience; Quaternary Geology

## T88. **Identification and Quantification of Groundwater Flow Using Heat as a Tracer:**

The use of heat as a groundwater tracer is currently experiencing a renaissance. We solicit abstracts discussing theoretical, modeling, and field investigations relating to the identification and quantification of groundwater using heat as a tracer.

**Advocates:** Christopher Lowry, University at Buffalo; Christine Hatch, University of Nevada–Reno; Laura Lutz, Syracuse University

**Cosponsors:** GSA Hydrogeology Division; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Environmental Geoscience

## T89. **Innovative Field Investigations to Assess Natural Attenuation and Engineered Remediation of Subsurface**

**Contamination:** This session will cover innovative chemical, physical, and microbiologic in situ methods developed to elucidate the fate of contaminants in a variety of hydrogeologic environments and focus on the elucidation and quantification of natural attenuation and remediation reaction progress.

**Advocates:** Isabelle M. Cozzarelli, USGS; Melinda L. Erickson, Mounds View, Minn.; Jennifer T. McGuire, University of St. Thomas; Jennifer R. McKelvie, Nuclear Waste Management Organization, Canada

**Cosponsors:** GSA Hydrogeology Division; Minnesota Ground Water Association; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Geochemistry, Organic; Geomicrobiology

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## T90. **Gas Bubbles and Dissolved Gases in Groundwater:**

This session encourages contributions related to understanding, monitoring, and simulating the behavior of gases (dissolved or bubbles) in groundwater, with implications for topics ranging from global element cycling to tracing groundwater flow to contaminant remediation.

**Advocates:** James W. Roy, Environment Canada; M.C. Ryan, University of Calgary, Canada; Kevin G. Mumford, Queen's University

**Cosponsors:** GSA Hydrogeology Division; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Geomicrobiology; Geochemistry

## T91. **Geology in the National Forests and Grasslands:**

**Stewardship, Education, and Research:** This session will explore aspects of geological science conducted on National Forests and Grasslands. Topics include paleontology, cave and karst geology, engineering geology and natural-hazard mitigation, hydrogeology, interpretive and recreational geology, geo-ecology, and more.

**Advocates:** Michael A. Crump, USDA Forest Service; Christopher P. Carlson, USDA Forest Service

**Cosponsors:** GSA Geology and Society Division; GSA Hydrogeology Division; GSA Quaternary Geology and Geomorphology Division; USDA Forest Service; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Geomorphology; Geoscience Education

## T92. **Buried Valley Aquifers: What Do We Know and How Do We Move Forward for Sustained Groundwater Management?:**

This session will profile emerging knowledge and concepts of buried-valley aquifer geometry, character, hydrochemistry, hydraulics, geophysical investigative techniques, and the importance of this setting for water supply and shallow energy resources.

**Advocates:** Hazen A.J. Russell, Ottawa, Ontario; David R. Sharpe, Geological Survey of Canada; Robert Shaver, North Dakota State Water Commission; Bruce D. Smith, USGS

**Cosponsors:** GSA Hydrogeology Division; GSA Quaternary Geology and Geomorphology Division; GSA Sedimentary Geology Division; GSA Geophysics Division; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Geomorphology; Quaternary Geology

T93. **Pseudokarst:** This session will focus on any aspect of pseudokarst, including groundwater piping, suffusion, tectonic processes, talus, wind ablation, littoral (wave action), permafrost, subglacial, and rheogenic (lava tubes).

**Advocates:** Lewis Land, New Mexico Bureau of Geology and Mineral Resources; Greg Brick, University of Minnesota

**Cosponsors:** GSA Hydrogeology Division; National Cave and Karst Research Institute; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Geomorphology; Volcanology

## T94. **Advances in Characterization of Groundwater Flow**

**Processes:** This session will serve as a forum to discuss recent advances in the study of flow and transport in groundwater using approaches from aquifer hydraulics, geophysics, tracers, and novel drilling techniques.

**Advocates:** Remke L. Van Dam, Michigan State University; Vitaly A. Zlotnik, University of Nebraska–Lincoln

**Cosponsors:** GSA Hydrogeology Division; GSA Geophysics Division; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Geophysics/Tectonophysics/Seismology; Environmental Geoscience

## T95. **Visualizations in Geology: Advancing the Science Using Digital Tools (Digital Posters):**

Geologic science using complicated visualization or modeling approaches is difficult to present using standard poster formats. This session allows geologic research to be communicated in a digital poster session format.

**Advocates:** Todd Halihan, Oklahoma State University; Daniel A. Lao Davila, Oklahoma State University; Priyank Jaiswal, Oklahoma State University

**Cosponsor:** GSA Hydrogeology Division

**Disciplines:** Hydrogeology; Geophysics/Tectonophysics/Seismology; Structural Geology

## T96. **Carbon and Water Dynamics in Peatlands and Their Relationship to Climatic Change:**

This session will focus on carbon and water fluxes in peatlands with respect to their role as important sources or sinks for greenhouse gases in a changing environment.

**Advocates:** Paul Glaser, University of Minnesota; Donald I. Siegel, Syracuse University; Andrew S. Reeve, University of Maine–Orono

**Cosponsor:** GSA Hydrogeology Division

**Disciplines:** Hydrogeology; Limnogeology; Environmental Geoscience

## T97. **Advances in Understanding at the Groundwater–Surface Water Interface and Challenges for the Future:**

**A Reflection on Tom Winter's Legacy:** This session will commemorate Tom Winter's contributions to the study of groundwater–surface-water exchange, discuss how they affect lake and wetland paleolimnology and hydrology, and suggest challenges and directions for future research and water-resource management.

**Advocates:** Donald O. Rosenberry, USGS; Walter E. Dean, Geology and Environmental Change Science Center, Denver, Colo.; Melinda L. Erickson, Mounds View, Minn.

**Cosponsors:** GSA Hydrogeology Division; GSA Limnogeology Division; Minnesota Ground Water Association; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Limnogeology

## T98. **Advancements in Subseafloor Hydrogeology:**

**Observations, Monitoring, and Modeling:** Subseafloor technologies are expanding our understanding of fluid, heat, and chemical fluxes within the subseafloor. These

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technologies provide data for integrated models to constrain transients and driving forces of nearshore and offshore subsurface flow systems.

**Advocates:** Brandon Dugan, Rice University; Alicia Wilson, University of South Carolina

**Cosponsor:** GSA Hydrogeology Division

**Disciplines:** Hydrogeology; Marine/Coastal Science; Geochemistry

## T99. **Hydrogeology of Glaciated Terrain: Linking Glacial Geology, Quaternary History, and Groundwater Research:**

Aquifers and aquitards of glacial origin present a unique challenge for hydrogeologists. Papers that link glacial geology and Quaternary history with studies of groundwater recharge, hydraulics, age dating, hydrogeochemistry, fracture flow, and modeling are encouraged.

**Advocates:** William W. Simpkins, Iowa State University; Richard Gerber, Oak Ridges Moraine Hydrogeology Program

**Cosponsors:** GSA Hydrogeology Division; International Association of Hydrogeologists; GSA Quaternary Geology and Geomorphology Division; National Ground Water Association; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Quaternary Geology; Environmental Geoscience

## T100. **Exploration of Karst Aquifer Systems Using New and Innovative Techniques and Methods (Posters):**

This session will explore new and innovative techniques and methods used to identify karst aquifer geometries, to delineate flow paths in karst aquifers, and to discern contaminant storage and transport pathways within karst aquifers.

**Advocates:** Eric W. Peterson, Illinois State University; Toby Dogwiler, Winona State University

**Cosponsors:** GSA Hydrogeology Division; Karst Waters Institute; GSA Engineering Geology Division

**Disciplines:** Hydrogeology; Quaternary Geology; Remote Sensing/Geographic Info System

**T101. Problems in Hydrostratigraphy and the Usage of Its Nomenclature:** This multidisciplinary session focuses on hydrostratigraphic mapping and modeling, with an emphasis on the current issues and problems related to hydrostratigraphic nomenclature.

**Advocates:** Charles D. Blome, USGS; David R. Wunsch, National Ground Water Association

**Cosponsors:** GSA Hydrogeology Division; GSA Geology and Society Division; North American Commission on Stratigraphic Nomenclature; Association of American State Geologists; National Ground Water Association; Micropaleontology Press

**Disciplines:** Hydrogeology; Stratigraphy

**T102. Shallow Lakes and Wetlands: Sedimentary Records and Modern Dynamics of Small Systems That Pack a Big Punch in the Carbon Cycle:** Small, shallow lakes and wetlands are surprisingly efficient at sequestering carbon. This session will explore carbon burial and the sediment

geochemistry of shallow lakes through modern observations and paleolimnological reconstructions of these systems.

**Advocates:** Kevin M. Theissen, University of St. Thomas; Will Hobbs, Science Museum of Minnesota; Joy M. Ramstack, Science Museum of Minnesota

**Cosponsor:** GSA Limnogeology Division

**Disciplines:** Limnogeology; Environmental Geoscience; Geochemistry

**T103. Processes within Extreme Lake Systems:** This session explores the aqueous geochemistry, physical limnology, and extremophile ecology of extreme lake systems and their interaction with groundwater, including saline lakes, acidic/basic mine pit lakes, volcanic crater lakes, hot springs, and polar lakes.

**Advocates:** Devin N. Castendyk, State University of New York College at Oneonta; Laurie S. Balistrieri, USGS

**Cosponsors:** GSA Limnogeology Division; GSA Hydrogeology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

**Disciplines:** Limnogeology; Geochemistry; Hydrogeology

## T104. **Urban and Suburban Lakes: Paleorecords of Human Impacts and Opportunities for Geoscience Education:**

Interdisciplinary research and/or pedagogical approaches using lake sediment cores covering the historical period. Includes student projects on records of development, pollution, remediation, watershed manipulation, and aspects of geochemistry, sedimentology, ecology, hydrogeology, history, public policy, etc.

**Advocates:** Amy Myrbo, University of Minnesota; Kate S. Pound, St. Cloud State University

**Cosponsors:** GSA Limnogeology Division; GSA Geoscience Education Division; National Association of Geoscience Teachers

**Disciplines:** Limnogeology; Geoscience Education; Environmental Geoscience

## T105. **Geological and Biological History and Future of the Great Lakes:**

The Great Lakes and their basin have changed over time due to tectonic, glacial, ecological, climatic, and human influences. Presentations will explore the past and future of the lakes in light of stressors and restoration efforts.

**Advocates:** John F. Bratton, NOAA; Steven Colman, Large Lakes Observatory

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; GSA Geology and Society Division; GSA Structural Geology and Tectonics Division; GSA Limnogeology Division

**Disciplines:** Limnogeology; Quaternary Geology; Public Policy

## T106. **The Mono Lake Basin: A Gathering of Disciplines:**

At Mono Lake, biogeochemical, volcanologic, paleoclimatic, hydrologic, geomorphologic, tectonic, and limnologic processes are often intertwined. Presentations may focus on the modern processes, glacial-era changes, geologic history, or regional context of the Mono Lake basin.



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**Advocates:** Susan Herrgesell Zimmerman, Lawrence Livermore National Laboratory; Sidney Hemming, Columbia University

**Cosponsors:** GSA Limnogeology Division; GSA Quaternary Geology and Geomorphology Division; GSA Structural Geology and Tectonics Division; GSA Geobiology & Geomicrobiology Division; GSA Geophysics Division; GSA Hydrogeology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Sedimentary Geology Division

**Disciplines:** Limnogeology; Quaternary Geology; Tectonics

**T107. Lacustrine Carbonates:** Carbonates in lake deposits are important in assessing the watershed landscape and hydrology of a basin and in establishing paleoclimatic signals on a regional scale.

**Advocates:** Elizabeth Gierlowski-Kordesch, Ohio University; Walter E. Dean, Geology and Environmental Change Science Center, Denver, Colo.

**Cosponsors:** GSA Limnogeology Division; GSA Geobiology & Geomicrobiology Division; GSA Sedimentary Geology Division

**Disciplines:** Limnogeology; Sediments, Carbonates

**T108. Lake Margin Environments as Dynamic Recorders of**

**Fossils and Climate Change:** This session will highlight the dynamic nature of lake margin environments and showcase their potential for preserving exquisite fossil remains, trace fossils, and high-resolution records of climate change.

**Advocate:** Cynthia M. Liutkus, Appalachian State University

**Cosponsors:** GSA Limnogeology Division; GSA Sedimentary Geology Division; GSA Quaternary Geology and Geomorphology Division

**Discipline:** Limnogeology

**T109. Limnogeology: Interdisciplinary Studies of Lakes**

**and Paleolakes (Posters):** Posters are encouraged that present basic and applied research on all aspects of modern or ancient lakes. Topics may complement ongoing oral sessions and are requested from all areas of limnogeology and related fields.

**Advocates:** Daniel Deocampo, Georgia State University; Amy Myrbo, University of Minnesota

**Cosponsors:** GSA Limnogeology Division; GSA Sedimentary Geology Division

**Discipline:** Limnogeology

**T110. Techniques for Measuring Shoreline Change**

**(Digital Posters):** This session will explore the state of the science of shoreline change measurement and where we should be heading in terms of equipment, data gathering techniques, and methods of analysis.

**Advocate:** Chester W. Jackson, Georgia Southern University

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Marine/Coastal Science; Remote Sensing/Geographic Info System; Environmental Geoscience

**T111. Geology of Unconventional Fossil Energy**

**Resources:** Understanding the geological properties of unconventional fossil resources and the links to production have helped to develop these hydrocarbons. This session will focus on recent geological insights into gas and oil shales and other unconventional formations.

**Advocates:** Daniel Soeder, U.S. Department of Energy; Thomas Mroz, USDOE/NETL

**Cosponsor:** GSA Sedimentary Geology Division

**Disciplines:** Economic Geology; Environmental Geoscience; Engineering Geology

**T112. Geology and Mineral Deposits of the Midcontinent**

**Rift:** This session highlights the renewed interest in the tectonomagmatic evolution and metallogenesis of the Midcontinent Rift generated by recent geochronologic, geochemical, and geophysical studies and new discoveries of Cu-Ni-PGE deposits associated with the 1.1 Ga Midcontinent Rift.

**Advocates:** James D. Miller, University of Minnesota-Duluth; Suzanne Nicholson, USGS; R. Michael Easton, Precambrian Geoscience Section, Sudbury, Ontario; Joshua Feinberg, University of Minnesota

**Cosponsors:** Society of Economic Geologists; UMD-Precambrian Research Center; Institute on Lake Superior Geology; GSA Geophysics Division

**Disciplines:** Economic Geology; Petrology, Igneous; Precambrian Geology

**T113. Tectonics and Metallogeny:** This session draws attention to the links between tectonics and metallogeny from primary genesis (magmatism, metamorphism), controlling the distribution of metals to the role of subsequent geological processes (deformation) on ore-bodies that we exploit today.

**Advocates:** David Schneider, University of Ottawa; John Jamieson, University of Ottawa

**Cosponsors:** Society of Economic Geologists; GSA Structural Geology and Tectonics Division; GSA Geophysics Division

**Disciplines:** Economic Geology; Tectonics; Geochemistry

**T114. Measuring the True Shape of the Earth:**

**Quantitative and Qualitative Applications of Terrestrial**

**LiDAR:** This session will focus on new efforts and approaches to extracting quantitative and qualitative geologic and environmental features from terrestrial LiDAR data.

**Advocates:** Ian P. Madin, Oregon Department of Geology and Mineral Industries; Donald E. Luman, Illinois State Geological Survey

**Cosponsors:** GSA Archaeological Geology Division; GSA Structural Geology and Tectonics Division; GSA Geoinformatics Division; GSA Quaternary Geology and Geomorphology Division; GSA Engineering Geology Division

**Disciplines:** Engineering Geology; Environmental Geoscience; Geomorphology

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## T115. **Geology and Human History: Resources, Climate, and Natural Hazards and Their Impact on Civilization:**

This session will explore how human history has been shaped by the distribution of resources, the ever-changing climate, and sudden natural disasters, as well as the impact of human societies on the natural world.

**Advocates:** Nathalie Nicole Brandes, Lone Star College–Montgomery; Paul T. Brandes, Geologic Consultant, Cypress, Texas

**Cosponsor:** GSA Engineering Geology Division

**Discipline:** Engineering Geology

## T116. **Geomicrobiology of Toxic Trace Elements in Aquatic Ecosystems:**

Geomicrobiological processes affect the mobilization, sequestration, and bioavailability of toxic trace metalloids in aquifers, lakes, streams, estuaries, and other aquatic ecosystems. This session will focus on trace element biogeochemistry in both freshwater and extreme environments.

**Advocates:** Thomas R. Kulp, USGS; Jiin-Shuh Jean, National Cheng Kung University, Taiwan; Jochen Bundschuh, National Cheng Kung University, Taiwan

**Cosponsors:** GSA Geobiology & Geomicrobiology Division; GSA Geology and Health Division; GSA Hydrogeology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

**Disciplines:** Geomicrobiology; Environmental Geoscience; Hydrogeology

## T117. **Uranium in Groundwater: Biogeochemical Controls on Mobility and Persistence:**

The persistence of uranium groundwater plumes continues to challenge routine prediction of natural attenuation. This session explores emerging improvements in quantifying sources of uranium contamination and seeks promising approaches supporting accurate prediction of uranium plume behavior.

**Advocates:** Philip E. Long, Pacific Northwest National Laboratory; Kenneth H. Williams, Lawrence Berkeley National Laboratory; Richard Dayvault, SM Stoller Inc.; Richard Bush, U.S. Department of Energy; David Peterson, SM Stoller Inc.

**Cosponsors:** GSA Hydrogeology Division; GSA Geobiology & Geomicrobiology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

**Disciplines:** Environmental Geoscience; Geochemistry; Geomicrobiology

## T118. **International Development and the Geosciences:**

Presentations will include a wide variety of case studies demonstrating the practical application of geoscience in serving the global needs of people and their environment.

**Advocates:** Stephen E. Silliman, University of Notre Dame; Michael D. Guebert, Taylor University

**Cosponsors:** GSA Geology and Society Division; GSA Geology and Health Division; American Geological Institute; YES Network; GSA Hydrogeology Division; Association of Geoscientists for International Development; Affiliation of Christian Geologists; GSA Engineering Geology Division

**Disciplines:** Environmental Geoscience; Hydrogeology; Geology and Health

## T119. **Sigma Gamma Epsilon Undergraduate Research (Posters):**

The goal of this session is to highlight recent and ongoing undergraduate research in a student-friendly forum. The session is open to students and faculty co-authors working in any area of the geosciences.

**Advocate:** Erika R. Elswick, Indiana University

**Disciplines:** Environmental Geoscience; Paleontology, Biogeography/Biostratigraphy; Hydrogeology

## T120. **Limits on Human Systems—Lessons from the Geologic Record:**

This session will explore the concept of sustainability from a geoscientific standpoint. The focus is on how geosystems constrain the operation of ecologic and anthropogenic systems and how living systems respond to these constraints.

**Advocates:** Craig Cooper, Idaho National Laboratory; Jon Goodwin, University of Illinois

**Cosponsors:** GSA Geology and Society Division; GSA Geology and Public Policy Committee; GSA Engineering Geology Division; GSA Geoinformatics Division; GSA Geology and Health Division; GSA Hydrogeology Division; GSA Quaternary Geology and Geomorphology Division; GSA Sedimentary Geology Division

**Disciplines:** Environmental Geoscience; Public Policy; Hydrogeology

## T121. **Uranium Ore Deposits: From Genesis to Mine Tailings and Mining Wastes.**

**Advocates:** Ruizhong Hu, Chinese Academy of Sciences, China; Chen Zhu, Indiana University; Mostafa Fayek, University of Manitoba

**Disciplines:** Geochemistry; Economic Geology; Environmental Geoscience

## T122. **Sources, Transport, and Fate of Trace and Toxic Elements in the Environment:**

Relevant research dealing with trace and potentially toxic elements in the environment. Basic and applied research topics on trace elements in water, sediment, and rocks that relate to sources, transport and fate are encouraged.

**Advocates:** LeeAnn Munk, University of Alaska–Anchorage; David T. Long, Michigan State University; W. Berry Lyons, The Ohio State University

**Cosponsor:** International Association of GeoChemistry

**Disciplines:** Geochemistry; Environmental Geoscience; Geology and Health

## T123. **Monitoring and Understanding Our Landscape for the Long Term through Small Catchment Studies: A Tribute to the Career of Owen P. Bricker:**

Small catchment streams have been studied for many decades and reasons. We solicit papers that examine catchment processes from an interdisciplinary perspective, such as those conducted by Owen Bricker during his career at USGS.

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**Advocates:** Karen C. Rice, USGS; Pierre D. Glynn, USGS; Jill S. Baron, USGS

**Cosponsors:** GSA Hydrogeology Division; GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Geochemistry; Environmental Geoscience; Hydrogeology

## T124. **Potentially Toxic Elements in the Environment:**

**A Session for Students (Posters):** We encourage student (both graduate and undergraduate) poster presentations focused on the accumulation of potentially toxic elements, from both natural and anthropogenic sources, with an emphasis on the various pathways through which these elements accumulate.

**Advocates:** Jonathan Gourley, Trinity College; Douglas Allen, Salem State University; LeeAnn Munk, University of Alaska—Anchorage

**Cosponsor:** Geochemical Society

**Disciplines:** Geochemistry; Environmental Geoscience

## T125. **Assessing Potential Impacts of Geological Carbon Sequestration on Groundwater Quality: Geochemical and Hydrological Approaches (Posters):**

This session encourages presentations of innovative geochemical and hydrological research relevant to monitoring, modeling, and accounting for CO<sub>2</sub> sequestered in geological formations, especially risk assessment and remediation for CO<sub>2</sub> leakage and potential groundwater quality degradation.

**Advocates:** Peng Lu, Calera Corporation; Katherine Duncker Romanak, The University of Texas at Austin; Changbing Yang, The University of Texas at Austin

**Disciplines:** Geochemistry; Hydrogeology; Environmental Geoscience

## T126. **Marcellus Shale Natural Gas Development:**

**Geology, Geochemistry, and Engineering:** This session will explore the geology, geochemistry, and engineered development of the Marcellus Shale—the largest natural gas field in the continental United States—and associated waters.

**Advocates:** Tracy Bank, SUNY at Buffalo; Carl S. Kirby, Bucknell University

**Cosponsors:** GSA Hydrogeology Division

**Disciplines:** Geochemistry; Hydrogeology; Environmental Geoscience

## T127. **Tropical Small Mountainous River**

**Biogeochemistry: Terrestrial Losses, Internal Processing, Coastal Inputs, and Marine Burial:** We encourage contributions that examine biogeochemical cycling and fluxes, as well as paleo-records of temporal and spatial changes in fluxes and fate, of material delivered by tropical mountainous rivers and associated estuarine and coastal waters.

**Advocates:** Steven Goldsmith, Brown University; Ryan Moyer, USGS

**Cosponsors:** International Assoc. of Geochemistry

**Disciplines:** Geochemistry; Marine/Coastal Science; Paleoclimatology/Paleoceanography

## T128. **EARTHTIME Geochronology: Improving Age Interpretations through Integration and**

**Intercalibration:** High-resolution radiometric and astrochronological studies reveal complexities in both mineral dates and stratigraphic proxy records. We encourage contributions integrating diverse geological, geochemical, and geochronological methodologies to more robustly interpret the tempo of earth systems processes.

**Advocates:** Mark D. Schmitz, Boise State University; Linda A. Hinnov, Johns Hopkins University; Blair Schoene, Princeton University

**Disciplines:** Geochemistry; Stratigraphy; Paleoclimatology/Paleoceanography

## T129. **Spectroscopy for the Geosciences in the 21st Century:**

This session will examine current geoscience applications and future possibilities of absorption, fluorescence, X-ray, emission, and other types of spectroscopy.

**Advocates:** Russell S. Harmon, Research Triangle Park, N.C.; Nancy McMillan, New Mexico State University

**Cosponsors:** GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; International Association of GeoChemistry

**Discipline:** Geochemistry

## T130. **Topics in Geoarchaeology: Reconstructions of Ancient Landscapes and Paleoenvironments:**

This session focuses on sediments analyses and reconstructions of landscapes and paleoenvironments in archaeological contexts. Papers related to applied science methodologies—including archaeological prospection, survey, excavation, lab analyses, stratigraphy, and cultural heritage management—are welcome.

**Advocates:** Kathleen Nicoll, University of Utah; Laura Murphy, Kansas Geological Survey

**Cosponsors:** GSA Archaeological Geology Division; GSA Sedimentary Geology Division; GSA Quaternary Geology and Geomorphology Division; GSA Limnogeology Division

**Disciplines:** Archaeological Geology; Geomorphology; Stratigraphy

## T131. **Are There Links between Springs and**

**Archaeological Sites?:** Groundwater is protected from evaporation and is likely a dependable source of freshwater for humans in dry lands or during dry periods in humid terrains. This session examines the possible links between archaeology and springs.

**Advocates:** Gail M. Ashley, Rutgers University; Vance T. Holliday, The University of Arizona

**Cosponsors:** GSA Archaeological Geology Division; GSA Quaternary Geology and Geomorphology Division; GSA Limnogeology Division; GSA Hydrogeology Division; GSA Sedimentary Geology Division

**Disciplines:** Archaeological Geology; Quaternary Geology; Hydrogeology



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**T132. The History of Humans and the Hydrologic System: Exploring Relationships between Cultures, Climate, and Hydrology through Time:** The focal points of this session are (1) how modern/ancient cultures adapted land-use and subsistence strategies to cope with past climate and hydrologic changes; and (2) how these adaptations may have affected the hydrologic system.

**Advocates:** Kathleen Nicoll, University of Utah; John Holbrook, The University of Texas at Arlington; P. Kyle House, USGS

**Cosponsors:** GSA Archaeological Geology Division; GSA Sedimentary Geology Division; GSA Quaternary Geology and Geomorphology Division; GSA Engineering Geology Division

**Disciplines:** Archaeological Geology; Quaternary Geology; Hydrogeology

**T133. Tectonics and Civilization:** Culture, societies, and human endeavors all must survive tectonic activity and its consequences, and tectonics lays the ground rules. This session discusses this interaction, past and present, from all fields of geology and geophysics.

**Advocates:** Floyd W. McCoy, University Hawaii–Windward College; Karl Wegmann, North Carolina State University

**Cosponsors:** GSA Archaeological Geology Division; GSA Structural Geology and Tectonics Division; GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Archaeological Geology; Tectonics; Quaternary Geology

**T134. A Healthy Dose for the Future of Quaternary Geochronology: Developments in and Applications of Dosimetric Dating Techniques (Posters):** This session seeks posters presenting both applications of and methodological refinements for dosimetric dating methods, such as OSL, ESR, and Fission Track used to constrain the timing and rates of Quaternary geologic events and processes.

**Advocates:** Kenneth Lepper, North Dakota State University; Shannon A. Mahan, USGS

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Quaternary Geology; Geomorphology; Archaeological Geology

**T135. Quaternary Geology and Its Applications: In Honor of David M. Mickelson:** This session honors the achievements of Dr. David M. Mickelson by showcasing current science about glacial landform and sediment genesis, geotechnical properties of Quaternary sediments, and hydrogeologic investigations in glaciated terrains.

**Advocates:** William N. Mode, University of Wisconsin–Oshkosh; John W. Attig, University of Wisconsin–Extension; Kent M. Syverson, University of Wisconsin–Eau Claire

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; GSA Engineering Geology Division

**Disciplines:** Quaternary Geology; Geomorphology; Hydrogeology

**T136. Wind, Water, and Ice: The Geomorphology and Quaternary Geologic History of Great Lakes' Coasts:** This session will focus on the processes that have shaped Great Lakes' coasts, including deglaciation, lake-level change, coastal erosion, and aeolian transport, as well as the history that has resulted from these processes.

**Advocates:** Edward C. Hansen, Hope College; Timothy Fisher, University of Toledo

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Quaternary Geology; Geomorphology; Marine/Coastal Science

**T137. MIS 4 and 3 Were Bigger Than You Think: Evidence From Geomorphic and Sedimentary Records:** While global ice volume was greatest in OIS 2, geomorphic response during OIS 4 and 3 was greater in many locations. Topics for this session include research on alluvial fans, loess, pluvial lakes, coasts, river terraces, and glacial chronologies.

**Advocates:** Tammy M. Rittenour, Utah State University; Glenn D. Thackray, Idaho State University

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Quaternary Geology; Geomorphology

**T138. Honoring Maynard M. Miller, Founder of the Juneau Icefield Research Program:** This session honors Maynard M. Miller for his unparalleled impact on stimulating study of earth-systems science in the alpine and glacial environment and for mentoring dozens who now lead in the study of arctic sciences.

**Advocates:** P. Jay Fleisher, SUNY-Oneonta; Guy Adema, Foundation for Glacier and Environmental Research

**Cosponsors:** Foundation for Glacier and Environmental Research; GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Quaternary Geology; Geoscience Education; Geomorphology

**T139. Extreme Climate and Weather Events: Past, Present, and Future:** This session seeks scientists from many disciplines to examine extreme climate and weather events. Such events have increased significantly in frequency and intensity during the last four decades. Presenters are encouraged to interpret this trend.

**Advocates:** George T. Stone, Milwaukee Area Technical College; Andrew M. Buddington, Spokane Community College; Michael E. Mann, Penn State University; Mark A. Chandler, Columbia University, NASA/GISS

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; The American Quaternary Association; American Water Resources Association; GSA Geology and Health Division; GSA Geology and Society Division; GSA Geoscience Education Division; GSA Hydrogeology Division; GSA Quaternary Geology and Geomorphology Division; International Union for Quaternary Research; National Association of Geoscience Teachers; GSA Engineering

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Geology Division; Association of Environmental & Engineering Geologists

**Disciplines:** Quaternary Geology; Hydrogeology; Public Policy

## T140. **Glacial Lake Agassiz—Its History and Influence on North America and on Global Systems: In Honor of James T. Teller:**

New research on the history and influence of Lake Agassiz during the last deglaciation will be presented, including that found in the lake basin, downstream from the lake, in the oceans, and on other continents.

**Advocates:** Steven Colman, Large Lakes Observatory; Nat Rutter, University of Alberta

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; GSA Limnogeology Division; American Quaternary Association; Canadian Quaternary Association; International Union for Quaternary Research

**Disciplines:** Quaternary Geology; Limnogeology; Paleoclimatology/Paleoceanography

## T141. **Quaternary Paleoclimate Studies of the Western and Southwestern United States:**

This session will recognize research that Larry Benson has done on the Quaternary in the Lahontan and Mono basins and elsewhere that has advanced the understanding of the paleoclimate and archaeology in western North America.

**Advocates:** Joseph C. Liddicoat, Barnard College; Berry Lyons, Ohio State University; Steve P. Lund, University of Southern California—Los Angeles; Joseph P. Smoot, USGS; Robert M. Negrini, California State University

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Quaternary Geology; Paleoclimatology/Paleoceanography; Archaeological Geology

## T142. **Evolution of Coastal Change in the Northern Gulf of Mexico:**

This session will focus on natural and anthropogenic environmental changes, including sea-level rise, storm events, climate, habitat loss, and morphologic changes in coastal regions of the northern Gulf of Mexico over the past several centuries.

**Advocates:** Lisa E. Osterman, USGS; Christopher G. Smith, USGS

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Quaternary Geology; Paleoclimatology/Paleoceanography; Environmental Geoscience

T143. **Glacial Geology and Cryogenic Processes:** This session will focus on Quaternary and glacial geology, Quaternary stratigraphy, chronology and climate history, cryospheric processes, and geomorphology. We welcome contributions on both past and modern glacial and periglacial environments.

**Advocates:** Anders Schomacker, Norwegian University of Science and Technology, Trondheim, Norway; Mark D. Johnson, University of Gothenburg, Göteborg, Sweden; Ívar Örn Benediktsson, University of Iceland, Reykjavík, Iceland; Michael L. Prentice, Bloomington, Indiana

**Disciplines:** Quaternary Geology; Paleoclimatology/Paleoceanography; Geomorphology

## T144. **Advances in Southern Laurentide Ice Sheet**

**Chronology and Glacial Dynamics:** This session will focus on the chronology and glacial dynamics of the southern Laurentide Ice Sheet during the Last Glacial Maximum and deglaciation.

**Advocates:** David J. Ullman, University of Wisconsin—Madison; B. Brandon Curry, Illinois State Geological Survey

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division

**Disciplines:** Quaternary Geology; Paleoclimatology/Paleoceanography

## T145. **Geology in the National Parks: Research, Mapping, Outreach, and Resource Management:**

This session addresses the role of geoscience in the National Parks. Presentations are open to geologic research, geologic mapping, paleontology, coastal geology, glacier studies, and resource management in National Parks, Monuments, Seashores, and Historic Sites.

**Advocates:** Bruce A. Heise, National Park Service; Tim Connors, National Park Service; Jason P. Kenworthy, Geologic Resources Division

**Cosponsors:** GSA Geophysics Division; GSA Quaternary Geology and Geomorphology Division; GSA Engineering Geology Division

**Disciplines:** Geoscience Education; Environmental Geoscience; Geoscience Information/Communication

## T146. **Student-Involved Research Experience in Earth-System Science: An Effective Tool for Recruitment and Retention in the Geosciences (Posters):**

This session will enable participating students to share their field-based earth-system science content knowledge by demonstrating research potential. Topics are wide open and may include global climate change, pollution, and natural hazards—related information.

**Advocates:** Nazrul I. Khandaker, York College of CUNY; Stanley Schleifer, York College of CUNY

**Cosponsors:** National Association of Geoscience Teachers; GSA Geoscience Education Division; GSA Geology and Society Division

**Disciplines:** Geoscience Education; Environmental Geoscience; Geoscience Information/Communication

T147. **What Are Undergraduates Learning in/from Our Programs? (Posters):** Program review and information on learning outcomes are important in saving our programs.

**Advocate:** Solomon A. Isiorho, Indiana University—Purdue University Fort Wayne

**Cosponsor:** National Association of Geoscience Teachers

**Disciplines:** Geoscience Education; Environmental Geoscience; History and Philosophy of Geology

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**T148. Geophotography across the Spectrum:** Imaging of geologic features and processes is a core geosciences skill. This session focuses on use of and best practices involving photographic, stereoscopic, and specialized imaging techniques applied to natural and artificial features and processes.

**Advocates:** J.F. Magloughlin, Colorado State University; Brent H. Breithaupt, U.S. Bureau of Land Management; Neffra A. Matthews, U.S. Bureau of Land Management

**Disciplines:** Geoscience Education; Geoinformatics; Remote Sensing/Geographic Info System

**T149. Virtual Reality in Geoscience Education (Digital Posters):** This session covers virtual reality in formal and informal geoscience education at all levels: Google Earth, OmniGlobe, LiDAR, GigaPan, full-dome digital planetaria, caves, and resources for handheld devices, such as iPads and smart phones.

**Advocates:** Declan G. De Paor, Old Dominion University; Steven J. Whitmeyer, James Madison University; John E. Bailey, University of Alaska–Fairbanks

**Cosponsors:** GSA Geoscience Education Division; GSA Structural Geology and Tectonics Division; GSA Geoinformatics Division; GSA Planetary Geology Division; National Association of Geoscience Teachers; Google Inc.; Oxford University Press; Minnesota Planetarium Society

**Disciplines:** Geoscience Education; Geoinformatics; Structural Geology

**T150. Teaching about Hazards in the Geoscience**

**Classroom:** Natural and environmental hazards are opportunities to get students interested in geoscience topics. This session encourages educators to share successful strategies for addressing both the geoscience content and the societal factors involved.

**Advocate:** John R. McDaris, Carleton College

**Cosponsor:** National Association of Geoscience Teachers

**Disciplines:** Geoscience Education; Geology and Health; Environmental Geoscience

**T151. Engaging Early-Career Geoscientists and Geoscience Students in Outreach Activities:** This session focuses on best practices for engaging geoscience students and early-career geoscientists in community outreach programs by demonstrating various field, lab, and digital activities that allow for the communication and promotion of the geosciences.

**Advocates:** Mary Seid, Illinois State Geological Survey; Tiffany A. Rivera, Roskilde University Center, Denmark

**Cosponsors:** National Association of Geoscience Teachers; YES Network; American Geological Institute

**Disciplines:** Geoscience Education; Geoscience Information/Communication; Geochemistry

**T152. The Growing Role of Adjunct Faculty in the Earth**

**Sciences:** The number of part-time, nontenurable faculty on campuses across the United States continues to increase. We encourage speakers who will explore the problems and

potential solutions that arise as a result of the increase in contingent faculty.

**Advocates:** Sue Ann Finstick, Southern Utah University, Florida State College at Jacksonville, Darton College; Gwyneth Jones, North Seattle Community College, Bellevue College, Lake Washington Technical College, Trinity Lutheran College

**Cosponsors:** GSA Geoscience Education Division; National Earth Science Teachers Association; National Association of Geoscience Teachers

**Disciplines:** Geoscience Education; Geoscience Information/Communication; History and Philosophy of Geology

**T153. Effective Practices for Broader Impacts in K–12: How to Share Your Research and Make Meaningful**

**Contributions:** Presentations by K–12 educators, scientists, and outreach specialists will provide techniques for effectively reaching K–12 audiences. Presenters should provide examples of strong partnerships with K–12 educators that ensure that high-quality geoscience reaches K–12 students.

**Advocates:** Nicole LaDue, Michigan State University; Heather Pacheco, Arizona State University

**Cosponsor:** National Association of Geoscience Teachers

**Disciplines:** Geoscience Education; Geoscience Information/Communication; Public Policy

**T154. Implementation and Assessment of Interactive Strategies in Earth and Space Science Courses:** Classroom, laboratory, and field-based earth and space science education research and data provide insights into the effectiveness of interactive strategies at improving earth and space science literacy throughout the educational pipeline.

**Advocates:** Leilani Arthurs, Georgia Southern University; Sarah Bean Sherman, University of Hawaii

**Disciplines:** Geoscience Education; Geoscience Information/Communication; Public Policy

**T155. Broadening Participation in the Geosciences**

**(Posters):** This session covers barriers and solutions for broadening participation in the geosciences.

**Advocates:** Diana Dalbotten, University of Minnesota; Antony R. Berthelote, Salish Kootenai College; Amy Myrbo, University of Minnesota

**Cosponsor:** National Center for Earth-Surface Dynamics

**Disciplines:** Geoscience Education; Geoscience Information/Communication

**T156. Engaging Minority Undergraduate Students in the Geosciences:** The geosciences award the lowest percentage of degrees to STEM underrepresented minorities. This session will present information on programs that successfully recruit and engage minority undergraduate students to the geosciences.

**Advocates:** Lisa Majkowski, New Mexico Tech; Michael J. Pullin, New Mexico Tech

**Disciplines:** Geoscience Education; Geoscience Information/Communication

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## T157. **Innovative Hands-on Geoscience Lab and Class Activities for Use in Undergraduate Teaching (Posters):**

This session will serve as a showcase for active, hands-on, inquiry-based activities used in undergraduate teaching. Participants are required to make their hands-on activity available for the “Hands-on Gallery.” Participants can also upload instruction materials to the SERC website.

**Advocates:** Kate S. Pound, St. Cloud State University; Cathryn Manduca, Carleton College; Lee Schmitt, Hamline University  
**Cosponsors:** National Association of Geoscience Teachers; National Center for Earth-Surface Dynamics  
**Disciplines:** Geoscience Education; Geoscience Information/Communication

## T158. **Sense of Place, Geoparks and National Parks: Strategies for Improved Earth Science Education:**

This session investigates how sense of place affects our capacity to learn, drives advances in inquiry, and augments improved earth-science literacy with existing National Park initiatives and the development of UNESCO Geoparks.

**Advocates:** William I. Rose, Michigan Technological University; Erika C. Vye, Michigan Technological University; Mark F. Klawiter, Michigan Technological University  
**Cosponsors:** GSA Geoscience Education Division; National Association of Geoscience Teachers  
**Disciplines:** Geoscience Education; Geoscience Information/Communication

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**Cosponsors:** GSA Geoscience Education Division; National Association of Geoscience Teachers  
**Disciplines:** Geoscience Education; Geoscience Information/Communication

## T160. **Stories of Place: Place-Based Research Projects as a Vehicle for Geoscience Education and Service Learning:**

This session seeks to highlight and share those classroom techniques, field methods, research projects, and service learning programs that use student knowledge and interest in specific places as a mechanism for broader geoscience education.

**Advocate:** Sadredin C. Moosavi, University of Massachusetts–Dartmouth  
**Cosponsors:** GSA Geoscience Education Division; National Association of Geoscience Teachers; Council on Undergraduate Research  
**Disciplines:** Geoscience Education; Geoscience Information/Communication

## T161. **The Transition from Student to Investigator: Promising Classroom Strategies and Best Educational Practices:**

A critical change we seek in students is a shift in mindset from directed learning to that of an investigator. This session highlights successful strategies and best classroom practices for helping students become geoscience researchers.

**Advocates:** Jeffrey Ryan, University of South Florida; Elizabeth A. Heise, University of Texas at Brownsville  
**Cosponsors:** Council on Undergraduate Research; National Association of Geoscience Teachers  
**Disciplines:** Geoscience Education; Geoscience Information/Communication

## T162. **Increasing Accessible Opportunities in the Geosciences for Students with Disabilities: Current Research and Best Practices:**

Geoscience educators and students are encouraged to disseminate research findings and experiences in making geoscience curriculum accessible for physically disabled participants. This session will also promote awareness of the need to increase accessibility in the geosciences.

**Advocates:** Christopher Atchison, Ohio State University; Sharon Locke, Southern Illinois University  
**Cosponsors:** GSA Geoscience Education Division; National Earth Science Teachers Association; National Association of Geoscience Teachers; GSA Diversity in the Geosciences Committee; International Advisory for Geoscience Diversity  
**Disciplines:** Geoscience Education; History and Philosophy of Geology

## T163. **International Field Trips: Introducing Students to the Rocks of the World (Posters):**

This session will highlight the itineraries, logistics, activities, and geology of international field trips so others may learn how these trips can be organized for their own students.

**Advocates:** Richard Diecchio, George Mason University; Stanley Williams, Arizona State University–Tempe; David G. Bailey, Hamilton College  
**Disciplines:** Geoscience Education; Archaeological Geology

## T164. **Challenges and Successes in Involving Undergraduates in Research on Climate Change and Energy Resources:**

This session will highlight challenges, successful strategies, and rewards for engaging undergraduate students in research on naturally interdisciplinary and often controversial topics that have immediate social relevance, particularly climate change and energy resources.

**Advocates:** Anne E. Egger, Stanford University; Christopher S. Kim, Chapman University  
**Cosponsors:** Council on Undergraduate Research; GSA Geology and Society Division; GSA Geoscience Education Division; National Association of Geoscience Teachers  
**Disciplines:** Geoscience Education; Public Policy; Geoscience Information/Communication

## T165. **Geoscience for All: Strategies for Effectively Teaching a Broad Student Population: Lessons Learned**



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## **from Two-Year Colleges and Other Open-Door and**

**Diverse Institutions:** Teaching students with a wide range of backgrounds is critical at all institutions, but especially open-admission schools like community colleges. This session will focus on successful models for teaching and supporting all geoscience students.

**Advocates:** Eric M.D. Baer, Highline Community College; Joy M. Branlund, Southwestern Illinois College; Robert H. Blodgett, Austin Community College

**Cosponsors:** GSA Geoscience Education Division; National Association of Geoscience Teachers

**Disciplines:** Geoscience Education; Public Policy; Geoscience Information/Communication

## **T166. Geoscientists Without Borders®: A Model for the Development Programs That Apply Geoscience to Humanitarian Needs:**

This session will highlight the Geoscientists Without Borders® program and its associated projects, including the logistics of establishing projects and the impact the program and projects have made. The session will be broadcast via Web-cast.

**Advocates:** Leila M. Gonzales, American Geological Institute; Sophie J. Hancock, YES Network and Colorado School of Mines; William Barkhouse, Society of Exploration Geophysicists Foundation

**Cosponsors:** GSA Engineering Geology Division; YES Network; American Geological Institute; Society of Economic Geologists; Society of Exploration Geophysicists Foundation

**Disciplines:** Geoscience Education; Public Policy; Geoscience Information/Communication

## **T167. Time, Events, and Places: Understanding Temporal and Spatial Learning in Geoscience Education:**

Students have trouble learning about and reasoning with large temporal and spatial scales. This session will present geoscience education and cognitive science research on spatial and temporal thinking to offer possible ways to improve learning.

**Advocates:** Thomas Shipley, Temple University; Steven Semken, Arizona State University; Carol J. Ormand, Carleton College

**Cosponsors:** National Association of Geoscience Teachers; Spatial Intelligence and Learning Center

**Disciplines:** Geoscience Education; Public Policy; Geoscience Information/Communication

## **T168. Overcoming Threats to Earth and Space Science Instruction at K–12 Levels:**

This session will focus on some of the factors that influence whether earth science is taught in K–12 classrooms, with emphasis on issues that are not directly related to the earth-science “content.”

**Advocates:** Jacqueline E. Huntoon, Michigan Technological University; Carol A. Engelmann, Michigan Technological University

**Cosponsors:** National Association of Geoscience Teachers; National Earth Science Teachers Association; American Geological Institute

**Disciplines:** Geoscience Education; Public Policy

## **T169. Geo-Workforce Preparation for 21st-Century**

**Challenges:** This session will provide a forum for exploring geoscience programs in energy and climate change regarding student preparation for the workforce, gathering evidence of program outcomes, and sharing information about similar curricula and professional development.

**Advocates:** Marilyn J. Suiter, National Science Foundation; Lina C. Patino, National Science Foundation; David J. Matty, National Science Foundation

**Cosponsors:** GSA Geoscience Education Division; GSA Geophysics Division; National Association of Geoscience Teachers

**Disciplines:** Geoscience Education; Public Policy

## **T170. Using GIS and Remote Sensing to Teach**

**Geoscience in the 21st Century:** This session focuses on effective and innovative strategies for teaching geoscience using GIS and remote sensing at the undergraduate level and for better meeting the GIS and remote sensing needs of geology students.

**Advocates:** Barbara Tewksbury, Hamilton College; Brian M. Hynek, University of Colorado

**Cosponsors:** GSA Geoscience Education Division; On the Cutting Edge

**Disciplines:** Geoscience Education; Remote Sensing/ Geographic Info System

## **T171. Developing the Global Geoscientist through International Geoscience Networks and Research Projects:**

This session will focus on best practices for cultivating global geoscientists through the use of international geoscience networks and cutting-edge technologies and the development of international research projects from these international networks.

**Advocates:** Leila M. Gonzales, American Geological Institute and YES Network; Sophie J. Hancock, YES Network and Colorado School of Mines

**Cosponsors:** GSA Geoscience Education Division; YES Network; American Geological Institute; Society of Exploration Geophysicists Foundation; GSA Geophysics Division

**Discipline:** Geoscience Education

## **T172. Geocognition Research in Classroom, Laboratory, and Informal Environments:**

This session focuses on empirical research in cognition and learning sciences applied to the geosciences in laboratory, classroom, and informal environments, including visualization, problem solving, conceptual understanding, and the nature of expertise.

**Advocate:** Sheldon P. Turner, Geocognition Research Laboratory

**Cosponsors:** GSA Geoscience Education Division; National Association of Geoscience Teachers

**Discipline:** Geoscience Education

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## T173. **Geocognition Research in Field-Based**

**Environments:** This session focuses on empirical research in cognition and learning sciences applied to the geosciences in field environments, including navigation, decision making and problem solving, visualization, and the nature of expertise.

**Advocate:** Eric M. Riggs, Purdue University

**Cosponsors:** GSA Geoscience Education Division; National Association of Geoscience Teachers

**Discipline:** Geoscience Education

## T174. **Identifying and Addressing K–16 Student**

**Misconceptions in the Earth-Science Classroom:** K–16 student misconceptions range from factual and conceptual misunderstandings of content to the nature/process of scientific knowledge to what scientists are like. We seek presentations that highlight research and share classroom/laboratory activities addressing these misconceptions.

**Advocates:** Laura A. Guertin, Penn State Brandywine; Tanya Furman, The Pennsylvania State University; Jason Petula, The Pennsylvania State University; Scott McDonald, The Pennsylvania State University

**Cosponsor:** National Association of Geoscience Teachers

**Discipline:** Geoscience Education

## T175. **Innovative Approaches to Enhancing the Earth Science Competence and Confidence of Elementary**

**Teachers:** Young children display great curiosity about their world, yet elementary teachers often lack sufficient science background to confidently teach earth science. This session explores innovative approaches to supporting earth science in the elementary curriculum.

**Advocate:** Karen M. Campbell, University of Minnesota

**Cosponsors:** National Center for Earth-Surface Dynamics; National Center for STEM Elementary Education

**Discipline:** Geoscience Education

## T176. **Innovative Methods for Broadening Participation in the Geosciences through In-Service Teacher**

**Professional Development:** This session presents geoscientists with innovative methods for working with K–12 teachers on campus and in the field and also provides guidance and support for planning geoscience professional development with teachers.

**Advocates:** Carol Engelmann, Michigan Technological University; William I. Rose, Michigan Technological University; Jacqueline E. Huntoon, Michigan Technological University; Mark F. Klawiter, Michigan Technological University; Erika Vye, Michigan Technological University; Stephen R. Mattox, Grand Valley State University; Ann E. Benbow, American Geological Institute

**Cosponsors:** GSA Geoscience Education Division; American Geological Institute; National Association of Geoscience Teachers; National Earth Science Teachers Association

**Discipline:** Geoscience Education

## T177. **Place-Based Education, Traditional Knowledge, and Research on Tribal Lands: Special Considerations for**

## **Collaborating with Native Communities on Geoscience**

**Research (Posters):** This session highlights projects that incorporate traditional knowledge, successful collaboration on research in the geosciences on Native lands, and excellent examples of place-based education in action.

**Advocates:** Holly Pellerin, University of Minnesota; Amy Myrbo, University of Minnesota; Lowana Greensky, St. Louis County Schools; Diana Dalbotten, University of Minnesota; Emi Ito, University of Minnesota

**Cosponsors:** National Association of Geoscience Teachers; National Center for Earth-Surface Dynamics; LacCore/Limnological Research Center; University of Minnesota

**Discipline:** Geoscience Education

## T178. **Reaching the Next Generation: Tales of Successful Strategies and Frustrating Challenges from Teaching Earth-Science Courses for Pre-Service Elementary**

**Teachers:** Content courses specifically designed for pre-service elementary teachers often present unique challenges for instructors. This session includes effective course designs, lessons, methodologies, and research findings on factors that improve student learning within this context.

**Advocates:** Kyle Gray, University of Northern Iowa; Ann Bykerk-Kauffman, California State University

**Cosponsors:** GSA Geoscience Education Division; National Association of Geoscience Teachers

**Disciplines:** Geoscience Education

## T179. **Results from Undergraduate Research in the**

**Geosciences (Posters):** Participants are encouraged to present results from their undergraduate research experience in the geosciences.

**Advocates:** Diana Dalbotten, University of Minnesota; Karen M. Campbell, University of Minnesota

**Cosponsor:** National Center for Earth-Surface Dynamics

**Discipline:** Geoscience Education

## T180. **Solitary Geoscience Faculty: Collaborating outside**

**Our Programs:** Solitary geoscience faculty collaborate with departments and institutions outside their program through doing research with undergraduates. If you are one of these faculty, collaborators, or students, consider sharing the successes and challenges of your experience.

**Advocates:** Kyle C. Fredrick, California University of Pennsylvania; Abigail M.S. Domagall, Black Hills State University; Janis D. Treworgy, Principia College

**Cosponsors:** National Association of Geoscience Teachers; GSA Geoscience Education Division

**Discipline:** Geoscience Education

## T181. **Teaching and Learning in the Field: Helping**

**Students to “Read the Record” and “Tell the Story of**

**Earth”:** This session will focus on the instructional strategies, methods, and assessments that can be used to effectively support teaching and learning in the field at all instructional levels to help students to think as geoscientists.

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**Advocates:** David W. Mogk, Montana State University; J.W. Geissman, University of Texas at Dallas; Christopher Bailey, College of William & Mary; Miriam Barquero-Molina, University of Missouri

**Cosponsors:** GSA Geoscience Education Division; National Association of Geoscience Teachers; GSA Structural Geology and Tectonics Division; GSA Sedimentary Geology Division; GSA Hydrogeology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

**Discipline:** Geoscience Education

**T182. Teaching Geoscience Online:** Teaching geoscience in an online format offers a new frontier for connecting with our students. This session will provide examples of successful courses, activities, and pedagogic strategies for teaching geoscience online.

**Advocates:** Karin B. Kirk, Carleton College; William H. Hirt, College of the Siskiyous

**Cosponsors:** GSA Geoscience Education Division; National Association of Geoscience Teachers

**Discipline:** Geoscience Education

**T183. Teaching Students to Learn:** This session will include general discussion of the importance of helping students develop metacognitive and self-regulated learning skills and also will include examples of effective classroom activities that promote better learning skills in general.

**Advocates:** Dexter Perkins, University of North Dakota; Karl Wirth, Macalester College

**Cosponsors:** National Association of Geoscience Teachers; GSA Geoscience Education Division

**Discipline:** Geoscience Education

**T184. The 21st-Century Geoscience Classroom: Creating Learner-Centered Environments for Undergraduates (Digital Posters):** This session focuses on the innovative ways that instructors are using technology (Google Earth, gigapixel imagery, GIS, Web 2.0 tools, etc.) to create interactive environments that promote learning through experience rather than memorization.

**Advocates:** Candace L. Kairies Beatty, Winona State University; William Lee Beatty, Winona State University; Jennifer L. Piatek, Central Connecticut State University

**Cosponsor:** National Association of Geoscience Teachers

**Discipline:** Geoscience Education

**T185. Truth in Advertising: Do Students Gain Conceptual Awareness of Science in General Education Curricula?:**

Students in required general or liberal education courses constitute the largest group of geoscience students. The requirement exists to produce science literacy, but does such learning occur? How do we know?

**Advocates:** Edward Nuhfer, California State University–Channel Islands; Julie Libarkin, Michigan State University

**Cosponsors:** National Association of Geoscience Teachers; GSA Geoscience Education Division

**Discipline:** Geoscience Education

**T186. Registration and Discovery of Geoscience**

**Information Resources: Metadata, Search, and Catalogs:**

The proliferation of online data increases the need for more effective methods to register and discover resources on the Web. This session will include papers on the description and discovery of geoscience information resources.

**Advocates:** Stephen M. Richard, Arizona Geological Survey; Rusty Kimball, Texas A & M University

**Cosponsors:** GSA Geoinformatics Division; Geoscience Information Society

**Disciplines:** Geoscience Information/Communication; Geoinformatics; Geoscience Education

**T187. Delivering Geoscience Knowledge in Federal Systems: What Can the Old and New Worlds Learn from Each Other?:** Data is increasingly being managed and delivered from multiple component sources in North America and Europe. How are the geological communities there facing the challenges of giving the user access to consistent data?

**Advocates:** Ian Jackson, British Geological Survey; M. Lee Allison, Arizona Geological Survey; John Broome, Geological Survey of Canada

**Cosponsors:** GSA Geoinformatics Division; Association of American State Geologists; OneGeology; Geological Survey of Canada; British Geological Survey

**Disciplines:** Geoscience Information/Communication; Geoinformatics; Public Policy

**T188. Geologic Maps, Digital Geologic Maps, and Derivatives from Geologic and Geophysical Maps (Posters):** This poster session will highlight new geologic maps, mapping programs, and innovations in geological mapping, including data management, Web accessibility, 3-D, and applications in water and land management.

**Advocates:** Richard C. Berg, Illinois State Geological Survey; Ralph F. Crawford, The Geologic Mapping Institute; Michael W. Higgins, The Geologic Mapping Institute; Linda Jacobsen, USGS; E. Donald McKay, Illinois State Geological Survey; Hazen A.J. Russell, Ottawa, Ontario; David R. Soller, USGS; Harvey Thorleifson, University of Minnesota

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; GSA Engineering Geology Division; Association of American State Geologists; GSA Geology and Society Division; GSA Geoinformatics Division; GSA Structural Geology and Tectonics Division; GSA Hydrogeology Division; GSA Geophysics Division

**Disciplines:** Geoscience Information/Communication; Hydrogeology; Engineering Geology

**T189. Geological Mapping: Key to Successful**

**Management of Water and Land Resources:** This session will highlight new mapping and innovations in geological mapping, including data management, Web accessibility, 3-D, and applications in water and land management.

**Advocates:** Richard C. Berg, Illinois State Geological Survey; Holger Kessler, British Geological Survey; Linda Jacobsen, USGS; E. Donald McKay, Illinois State Geological Survey;

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Hazen A.J. Russell, Ottawa, Ontario; David R. Soller, USGS; Harvey Thorleifson, University of Minnesota

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; GSA Engineering Geology Division; Association of American State Geologists; GSA Geology and Society Division; GSA Geoinformatics Division; GSA Structural Geology and Tectonics Division; GSA Hydrogeology Division; GSA Geophysics Division

**Disciplines:** Geoscience Information/Communication; Hydrogeology; Engineering Geology

**T190. Geoscience Information: Preserving Access to the Past Is Key to Future Discoveries (Posters):** Librarians and information professionals provide researchers with numerous print and electronic resources, including older literature. This session will discuss the issues associated with the organization, preservation, and discoverability of geoscientific literature, from new to old.

**Advocate:** Rusty Kimball, Texas A&M University

**Cosponsor:** Geoscience Information Society

**Discipline:** Geoscience Information/Communication

**T191. Printed Past, Digital Future: The Key to Geoscience Information is in Your Library:** Geoscience information professionals provide access to numerous print and electronic resources that need to be maintained, organized, preserved, and made discoverable to geoscience researchers. This session will address the associated issues, challenges, and solutions.

**Advocate:** Rusty Kimball, Texas A&M University

**Cosponsors:** Geoscience Information Society; GSA Geoinformatics Division

**Discipline:** Geoscience Information/Communication

**T192. From Maps to Apps: Moving Toward a Comprehensive, Linked-Process Modeling Approach:**

This session addresses the entire digital geoscience data-collection, management, and dissemination process, including making and maintaining digital data resources, sophisticated 3-D/4-D geospatial models and visualizations, and collaborative Web-enabled outreach options.

**Advocates:** A. Keith Turner, Colorado School of Mines; D.A. Keefer, Illinois State Geological Survey; Holger Kessler, British Geological Survey

**Cosponsors:** GSA Engineering Geology Division; GSA Hydrogeology Division; GSA Geoinformatics Division; GSA Geology and Society Division; American Association of State Geologists; USGS; British Geological Survey

**Disciplines:** Geoinformatics; Environmental Geoscience; Hydrogeology

**T193. Complexity in Modeling: How Much Is Too Much?:**

Modeling is a state-of-the-practice tool. However, models—defined as being simplifications of reality—are often simplified subjectively, thus sub-optimally. This session focuses on methods to enhance application of model complexity to decision making.

**Advocate:** Randall Hunt, USGS

**Cosponsors:** GSA Hydrogeology Division; GSA Geology and Society Division; GSA Engineering Geology Division; Wisconsin Section—AWRA; Minnesota Ground Water Association; Australian National Centre for Groundwater Research and Training

**Disciplines:** Geoinformatics; Geoscience Information/Communication; Hydrogeology

**T194. Decision Support for the Geosciences: The Interface between Public, Policy, and Science:** Decision support for the geosciences can convey meaning and reveal patterns that are relevant for society. Pairing computational techniques and social processes expands understanding, access, and communication of science-based concepts for collaborative learning and informed dialog.

**Advocates:** Suzanne A. Pierce, Jackson School of Geosciences, The University of Texas at Austin; Tony Jakeman, The Australian National University

**Cosponsors:** GSA Geoinformatics Division; GSA Hydrogeology Division; GSA Geology and Society Division; GSA Geology and Health Division; U.S. National Chapter of International Association of the Hydrogeologists; Minnesota Ground Water Association; National Centre for Groundwater Research and Training

**Disciplines:** Geoinformatics; Geoscience Information/Communication; Hydrogeology

**T195. Data Preservation and Management in the Coming Decade:** This session explores integrating digital and physical information, future directions in geoscience preservation policies, and the challenges of sharing and managing data within the geosciences and among other entities, including libraries, data centers, and commercial publishers.

**Advocates:** Frances W. Pierce, 912 National Center; Brian J. Buczkowski, USGS; Betty M. Adrian, USGS; John C. Steinmetz, Indiana University; M. Lee Allison, Arizona Geological Survey

**Cosponsors:** GSA Geoinformatics Division; USGS; Association of American State Geologists; Geoscience Information Society; GSA Geophysics Division

**Disciplines:** Geoinformatics; Geoscience Information/Communication; Public Policy

**T196. Geoinformatics in Action (Posters):** The purpose of this session is to bring together geologists and geoinformatics practitioners to learn about operational systems that utilize geoinformatics, as well as prototype systems exploring the next generation of geoinformatics applications.

**Advocates:** Stephen M. Richard, Arizona Geological Survey; Tim Ahern, IRIS DMC; Richard P. Hooper, CUAHSI; Kerstin A. Lehnert, Columbia University

**Cosponsors:** GSA Geoinformatics Division; Lamont-Doherty Earth Observatory, Columbia University; Consortium of Universities for the Advancement of Hydrologic Science, Inc.; IRIS Data Management System

**Disciplines:** Geoinformatics; Geoscience Information/Communication; Remote Sensing/Geographic Info System



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**T197. Seeing the True Shape of Earth: Quantitative and Qualitative Applications of Airborne LiDAR:** This session will focus on new efforts and approaches to extract quantitative and qualitative geologic and environmental features from terrestrial and airborne LiDAR data.

**Advocates:** Ian P. Madin, Oregon Department of Geology and Mineral Industries; D.E. Luman, University of Illinois  
**Cosponsors:** GSA Archaeological Geology Division; GSA Structural Geology and Tectonics Division; GSA Geoinformatics Division; GSA Quaternary Geology and Geomorphology Division; GSA Engineering Geology Division  
**Disciplines:** Geoinformatics; Remote Sensing/Geographic Info System; Quaternary Geology

**T198. International Collaboration and the Evolution of Geology:** The impact of international collaboration (made possible by newly established scientific societies, journals, government surveys, and enhanced forms of travel and communication) on the rapid evolution of geology in the 19th century will be explored.

**Advocates:** John Diemer, University of North Carolina at Charlotte; Kenneth R. Aalto, Humboldt State University  
**Cosponsor:** GSA History and Philosophy of Geology Division  
**Discipline:** History and Philosophy of Geology

**T199. A Healthy Society, Geosciences, and Natural Resources:** Resources figure markedly in the future of a rapidly increasing global population expanding their lifestyles. Complex health and economic considerations created by such an expansion require cross-disciplinary exchange in order to benefit future cooperation.

**Advocates:** Catherine Skinner, Yale University; Eric Cheney, University of Washington  
**Cosponsors:** GSA Geology and Health Division; Society of Economic Geologists  
**Disciplines:** Geology and Health; Economic Geology; Environmental Geoscience

**T200. Erionite: Mineralogy, Geology, Health Risks, and Public Policy:** This session will provide a forum for geologists, mineralogists, and public health professionals to exchange current research results on the carcinogenic, fibrous zeolite erionite.

**Advocates:** Bernhardt Saini-Eidukat, North Dakota State University; Ahmet Umran Dogan, King Fahd University of Petroleum & Minerals, Saudi Arabia; Don Halterman, Salt Lake Technical Center  
**Cosponsors:** GSA Geology and Health Division; Mineralogical Society of America; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division  
**Disciplines:** Geology and Health; Environmental Geoscience; Mineralogy/Crystallography

**T201. Intersection of Geology and Health: Impacts of Geologic Materials on Public Health:** This session highlights the potential impacts of geologic materials (urban

and natural soils, mine wastes, oil spills, smelter emissions, coal fly ash, wildfire and volcanic ash, etc.) on public health.

**Advocates:** Geoffrey S. Plumlee, USGS; Jean M. Morrison, USGS  
**Cosponsors:** GSA Geology and Health Division; GSA Engineering Geology Division  
**Disciplines:** Geology and Health; Geochemistry; Environmental Geoscience

**T202. Coal Combustion Products and Impacts on Society:** This session addresses the impact of coal combustion products on the environment and society through interdisciplinary evaluation of the science of coal ash, its disposal to the environment, and the social implications.

**Advocate:** Avner Vengosh, Duke University  
**Cosponsor:** GSA Geology and Health Division  
**Disciplines:** Geology and Health; Hydrogeology; Coal Geology

**T203. Climate, Water, and Health:** This session will focus on the effects of drastic or abrupt climate changes on human and ecological health as they relate to water-quality issues.

**Advocates:** Saugata Datta, Kansas State University; Syed E. Hasan, University of Missouri–Kansas City; Hatim Sharif, University of Texas at San Antonio; Deon van der Merwe, Kansas State University

**Cosponsors:** GSA Geology and Health Division; GSA Hydrogeology Division; GSA Geology and Society Division; GSA Engineering Geology Division  
**Disciplines:** Geology and Health; Hydrogeology; Environmental Geoscience

**T204. Advances in Characterizing Sources and Release of Naturally Occurring Trace Elements to Aquatic Systems and Groundwater:** This session will focus on characterizing sources and mechanisms of release of naturally occurring trace elements to waters. We encourage abstracts addressing elemental speciation and advancement in analytical techniques for trace-element concentrations in geologic matrices.

**Advocates:** Sarah L. Nicholas, University of Minnesota; Brandy M. Toner, University of Minnesota  
**Cosponsors:** GSA Geology and Health Division; GSA Hydrogeology Division; Minnesota Ground Water Association; GSA Engineering Geology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division  
**Disciplines:** Geology and Health; Hydrogeology; Geochemistry

**T205. Combat Geology: Safeguarding Geologists in the Field:** How can we best protect geologists who routinely put their lives at risk working in remote frontier areas and regions of active armed conflict under conditions of “combat geology”?  
**Advocates:** M. Lee Allison, Arizona Geological Survey; Kathleen M. Johnson, USGS  
**Cosponsors:** USGS; Association of American State Geologists  
**Disciplines:** Public Policy; Economic Geology; Geoscience Education

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## T206. **STEMming the Tide: How Can We Promote Science**

**Literacy?:** As geoscientists, we need to make communicating with the public a high priority to improve how scientific concepts and constraints are incorporated into wise education and policies to help America to thrive in coming years.

**Advocates:** J.E. Fryxell, California State University–San Bernardino; David W. Szymanski, Bentley University; James F. Davis, COSMOS

**Cosponsors:** GSA Geology and Society Division; American Geological Institute; American Geophysical Union; Geology and Public Policy Committee; GSA Engineering Geology Division; GSA Geoscience Education Division; American Association of State Geologists; National Association of Geoscience Teachers

**Disciplines:** Public Policy; Environmental Geoscience; Geoscience Education

## T207. **Canada–United States Transboundary Geoscience**

**Issues:** Many geoscience issues span the border between Canada and the United States. The International Joint Commission, established by the Boundary Waters Treaty, provides a model for addressing shared waters and other transboundary geoscience issues.

**Advocate:** Craig Schiffries, Geological Society of America

**Cosponsor:** GSA Geology and Public Policy Committee

**Disciplines:** Public Policy; Environmental Geoscience; Hydrogeology

## T208. **Developing Resource Policies Informed by Geoscience: Applications from the Classroom to the Capitol**

As we enter the Anthropocene, we face the depletion of many important resources. This session will explore ways to ensure the geologic perspective on resource use and depletion is included in coursework and in policy making.

**Advocates:** Michael A. Phillips, Illinois Valley Community College; David W. Szymanski, Bentley University

**Cosponsors:** GSA Geology and Society Division; GSA Geology and Public Policy Committee; National Association of Geoscience Teachers; GSA Geophysics Division; GSA Geoscience Education Division

**Disciplines:** Public Policy; Geoscience Education; Economic Geology

## T209. **Support for Scientific Integrity and Scientists in an Age of Public Scrutiny**

Science is increasingly politicized and scientists are subject to unprecedented public attention. We will explore attempts to codify strong government scientific integrity standards, improve access to government data and scientists, and neutralize attacks on scientists.

**Advocates:** Francesca T. Grifo, Union of Concerned Scientists; William W. Simpkins, Iowa State University; Michael H. Halpern, Union of Concerned Scientists; Brenda Ekwurzel, Union of Concerned Scientists

**Cosponsor:** GSA Geology and Society Division

**Disciplines:** Public Policy; Geoscience Information/Communication; Environmental Geoscience

## T210. **Impact Cratering: Geology's Latest Revolution:**

Impact cratering is the most recent revolution in geological science; it has brought catastrophic events back into mainstream geology. This session will review the importance of this new geologic process.

**Advocates:** Jay Melosh, Purdue University; Elisabetta Pierazzo, Planetary Science Institute

**Cosponsors:** GSA Planetary Geology Division; GSA Geophysics Division

**Disciplines:** Planetary Geology; Geophysics/Tectonophysics/Seismology; Environmental Geoscience

## T211. **30+ Years of Teaching about Planetary Geology: Past Lessons Learned and Future Possibilities:**

We encourage abstracts that analyze past, present, and potential future teaching of planetary geology through textbooks, curriculum, and lab exercises at the university, K–12, and informal science education levels for science and non-science students.

**Advocates:** Jayne C. Aubele, New Mexico Museum of Natural History and Science; Eric J. Pyle, James Madison University

**Cosponsors:** GSA Planetary Geology Division; GSA Geoscience Education Division

**Disciplines:** Planetary Geology; Geoscience Education

## T212. **Impact Cratering on the Earth, Moon, and Planets: Remote, Field, and Lab Studies:**

This session solicits contributions on any aspect of impact crater studies (terrestrial and planetary), including recent observations of lunar craters that constrain geologic aspects of craters and provide information on the modeling of impacts.

**Advocates:** Christian Koeberl, University of Vienna; Jeffrey Plescia, Johns Hopkins University Applied Physics Laboratory

**Cosponsors:** GSA Planetary Geology Division; GSA Sedimentary Geology Division; GSA Geophysics Division; GSA Structural Geology and Tectonics Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; International Continental Drilling Program

**Disciplines:** Planetary Geology; Petrology, Metamorphic; Geochemistry

## T213. **Robotic Exploration of Planetary Surfaces: The G.K. Gilbert Award Session:**

This session celebrates the career and accomplishments of this year's recipient of the Planetary Geology Division's G.K. Gilbert Award. Oral presentations will be given by the awardee and by the awardee's former students and colleagues.

**Advocate:** David A. Williams, Arizona State University

**Cosponsor:** GSA Planetary Geology Division

**Disciplines:** Planetary Geology; Remote Sensing/Geographic Info System; Geochemistry

## T214. **Exploring Mercury by Spacecraft: First**

**MESSENGER Results from Orbit:** In March 2011,

*MESSENGER* is the first spacecraft to orbit Mercury. This session will highlight early scientific results from orbital observations, with an emphasis on the planet's geology, geochemistry, and geophysics.

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**Advocates:** Sean C. Solomon, Carnegie Institution of Washington; Louise Prockter, Planetary Exploration Group; David T. Blewett, Johns Hopkins University Applied Physics Laboratory

**Cosponsors:** GSA Planetary Geology Division; GSA Geophysics Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Structural Geology and Tectonics Division

**Disciplines:** Planetary Geology; Structural Geology; Volcanology

**T215. Terrestrial Analogs in Solar System Studies:** This session focuses on terrestrial analog studies with application to understanding other solar-system bodies, their geological histories, the processes operating on them, and the potential for habitable environments.

**Advocate:** Simon A. Kattenhorn, University of Idaho

**Cosponsors:** GSA Planetary Geology Division; GSA Structural Geology and Tectonics Division; GSA Geophysics Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Sedimentary Geology Division; GSA Quaternary Geology and Geomorphology Division; GSA

Geobiology & Geomicrobiology Division; GSA Limnogeology Division; GSA Hydrogeology Division

**Disciplines:** Planetary Geology; Structural Geology; Volcanology

**T216. Lava Flows: Earth and Beyond:** This session will focus on the way in which our increased understanding of lava flows has benefited from synergistic studies on Earth and on other planets.

**Advocates:** Larry S. Crumpler, New Mexico Museum of Natural History and Science

**Cosponsor:** GSA Planetary Geology Division

**Disciplines:** Planetary Geology; Volcanology; Petrology, Igneous

**T217. Dawn at Vesta: Initial Results from the Survey**

**Orbit:** The *Dawn* spacecraft will go into Vesta orbit in August 2011. Results from analysis of the initial observations of the survey orbit will be presented.

**Advocate:** Debra Buczkowski, Johns Hopkins University Applied Physics Laboratory

**Cosponsor:** GSA Planetary Geology Division

**Discipline:** Planetary Geology

*Let us help you arrange space for your event*

## 2011 Annual Meeting Space Requests

**Deadline:** 7 June 2011

### Q: What types of events should be submitted?

**A:** All events that require a meeting room and that you would like listed in the meeting program book—this includes alumni parties, banquets, awards/receptions, business meetings, Division meetings, committee meetings, town halls, and focus groups. Events you are organizing at an off-site location (other than the convention center or headquarter hotel) should be submitted as well. (Note: Space requests are not necessary for official GSA technical sessions.)

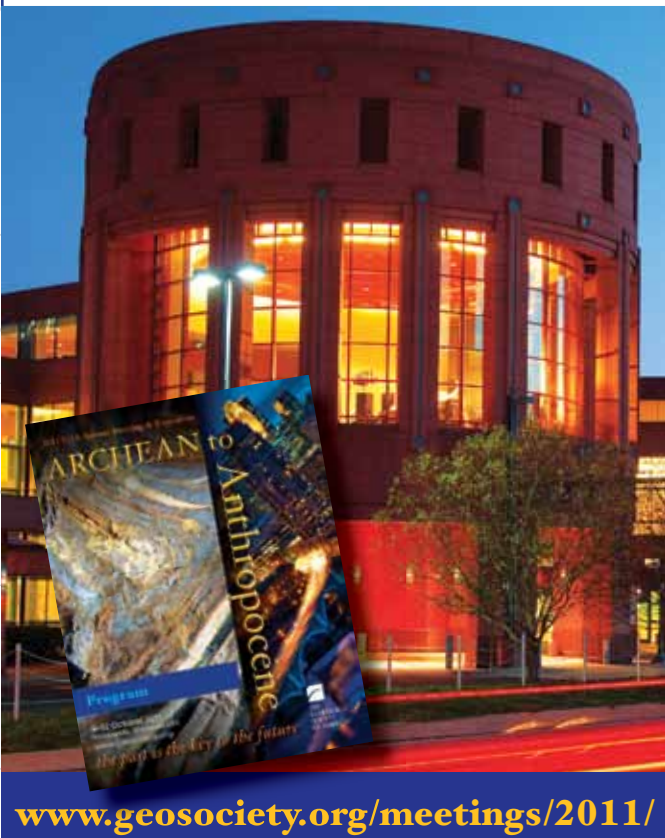
### Q: What information do you need in order to submit an event?

**A:** Just the information needed to reserve the right size room. This includes the date of your event, start and end times, estimated attendance, and the type of room set-up needed.

### Q: Why do I have to request my space so early?

**A:** Space is assigned on a first-come, first-served basis. When you sign up before the deadline, you'll receive confirmation in July on your room location so you can send out your event announcements early. Your event will also be listed in the program and on the personal scheduler. It's also a good idea to put in your request before you get too busy with summer activities and/or your field season. (Note: Events assigned to technical session rooms won't be confirmed until end of August but should still be submitted early.)

Photo used with permission from Meet Minneapolis Official Convention & Visitors Association. Minneapolis, Minnesota, skyline at night. Photo by Greg Benz, <http://carbonsilver.com/blog>.



[www.geosociety.org/meetings/2011/](http://www.geosociety.org/meetings/2011/)

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## PARDEE KEYNOTE SYMPOSIA

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

Pardee Keynote Symposia represent leading-edge, interdisciplinary science and address broad, fundamental geoscience issues and/or areas of public policy. Sessions are selected on a competitive basis by the Annual Program Committee; all speakers are invited.



Joseph T. Pardee

### **P1. The Frontiers of Quaternary Geochronology: Extension or Overextension of Dating Methods for Quaternary Geology and Geomorphology?**

A formidable array of Quaternary geochronological techniques has been developed over the last decade. This session brings together established scientists who have been instrumental in methodological developments for or applications of radiocarbon, optically stimulated luminescence, and cosmogenic nuclide dating as well as researchers who are now striving to take those techniques further. The latest advances will be placed in a context that will allow both seasoned professionals and students to scrutinize the techniques and evaluate their utility for future projects.

**Cosponsors:** GSA Quaternary Geology and Geomorphology Division; GSA Archaeological Geology Division; American Quaternary Association; Association for Women Geoscientists; Colorado Scientific Society.

**Discipline(s):** Quaternary Geology; Geomorphology; Archaeological Geology.

**Conveners:** Kenneth Lepper, North Dakota State University; Shannon A. Mahan, USGS.

**P2. Honoring British Geologist Arthur Holmes (1890–1965) for Contributions to Geochronology, Plate Tectonics, and the Origin of Granite.** One-hundred years ago, British geologist Arthur Holmes (1890–1965), while still an undergraduate student, established the technique to date rocks by the radioactive decay of U to Pb. Holmes also made highly significant contributions to the study of plate tectonics and the origin of granite.

**Cosponsors:** Geological Society London; GSA International Section; International Association of GeoChemistry; GSA History and Philosophy of Geology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Structural Geology and Tectonics Division.

**Discipline(s):** Geochemistry; History and Philosophy of Geology; Tectonics.

**Conveners:** Russell S. Harmon, North Carolina State University; Jon Davidson, University of Durham.

### **P3. Exploration of the Deep Biosphere.**

Current uncertainty in the distribution, activity, and ecology of microbial species in the deep biosphere is vast. This session is dedicated to highlighting advances in deep biosphere research in terrestrial and marine settings. Presentations will highlight the geomicrobiology, microbial ecology, physiology, and biogeography of deep, subsurface environments. Speakers are encouraged to discuss the development of field-based and theoretical observatories, as well as the application of new in situ technologies for measurements, sample collection, and experimentation.

**Cosponsor:** GSA Geobiology & Geomicrobiology Division.

**Discipline(s):** Geomicrobiology.

**Conveners:** Brandy M. Toner, University of Minnesota; Jeffrey Gralnick, University of Minnesota.

### **P4. Rare Earth Elements and Critical Minerals for a Sustainable and Secure Future.**

Widespread deployment of clean energy technologies can reduce greenhouse gas emissions, mitigate climate change, and reduce dependence on foreign oil. Many emerging technologies—such as wind turbines, solar cells, and electric vehicles—depend on rare earth elements (REEs) and other scarce elements that currently lack diversified sources of supply. For example, China accounts for 95% of the world production of REEs although, according to the U.S. Geological Survey, it has only 36% of identified world reserves. This session explores REEs and critical minerals in the context of emerging energy technologies and recent legislation and reports.

**Cosponsors:** GSA Geology and Society Division; GSA Geology and Public Policy Committee; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division.

**Discipline(s):** Public Policy; Economic Geology.

**Convener:** Craig Schiffries, Geological Society of America.

### **P5. The EarthScope Program: Recent Results and Future Project.**

EarthScope is a continental-scale geophysical and geological experiment to study the lithosphere of the United States. To date, several experiments involving broadband seismology, long-period magnetotellurics, the Plate Boundary Observatory, and the San Andreas Fault Observatory at Depth have investigated over half the lithosphere of the lower 48. The USArray seismic component is working its way eastward and is currently within the central United States. This session will highlight



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the research of all components of EarthScope. The design of future experiments in the central and eastern United States will also be detailed.

**Cosponsors:** GSA Geophysics Division; GSA Structural Geology and Tectonics Division; GSA Geoinformatics Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division.

**Discipline(s):** Geophysics/Tectonophysics/Seismology; Tectonics; Public Policy.

**Conveners:** Matthew J. Fouch, Arizona State University; Kevin Mickus, Missouri State University; Paul A. Bedrosian, USGS.

P6. **Prairie Ice Streams.** Session leaders are interested in understanding the deglacial dynamics and impact of terrestrial ice streams, ancient and modern. Questions concern how they propagate up-ice and at what rates they draw down their catchment areas; how the evolution is reflected in the sediment record down-ice; what basal conditions allow ice streams to maintain momentum and form lobes; how the record of subglacial conditions is preserved in the sediment and landforms; how the ultimate stagnation of the lobe affects the dynamics of the tributary ice streams; and how lobe stagnation affects local climate, including permafrost, ecosystems, and groundwater recharge.

**Cosponsor:** GSA Quaternary Geology and Geomorphology Division.

**Discipline(s):** Quaternary Geology; Paleoclimatology/Paleoceanography; Geomorphology.

**Conveners:** Carrie E. Jennings, University of Minnesota; Martin A. Ross, University of Waterloo; B. Brandon Curry, Illinois State Geological Survey.

## P7. **Earth's Early Atmosphere and Surface Environment.**

Investigations of the chemical state of Earth's early surface and atmosphere have been guided by geological evidence, cosmochemical analysis, and comparisons to other terrestrial bodies. This session will provide for presentation and discussion of several, often contradictory, models for the early Earth.

**Discipline(s):** Precambrian Geology; Geochemistry; Planetary Geology.

**Conveners:** Robert O. Pepin, University of Minnesota; George H. Shaw, Union College.

P8. **Global Water Sustainability:** This session will address the full spectrum of present and future issues and challenges facing humanity's requirement for water, its most critical resource.

**Cosponsors:** Mineralogical Society of America; Geochemical Society.

**Discipline(s):** Hydrogeology; Environmental Geoscience; Public Policy.

**Conveners:** Martin B. Goldhaber, USGS; John B. Brady, Smith College; Chen Zhu, Indiana University.



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## Graduate School Information Forum

This is a fantastic opportunity for you to promote your school and meet face-to-face with over 1,500 prospective students in a relaxed, informal setting at the 2011 GSA Annual Meeting & Exposition in Minneapolis, Minnesota, USA.

You can book your booths for one day or up to all four days. Schools reserving multiple days will receive priority and be assigned to the most visible booths. Sunday and Monday are usually the first to sell out, and space is limited, so we recommend that you reserve early!

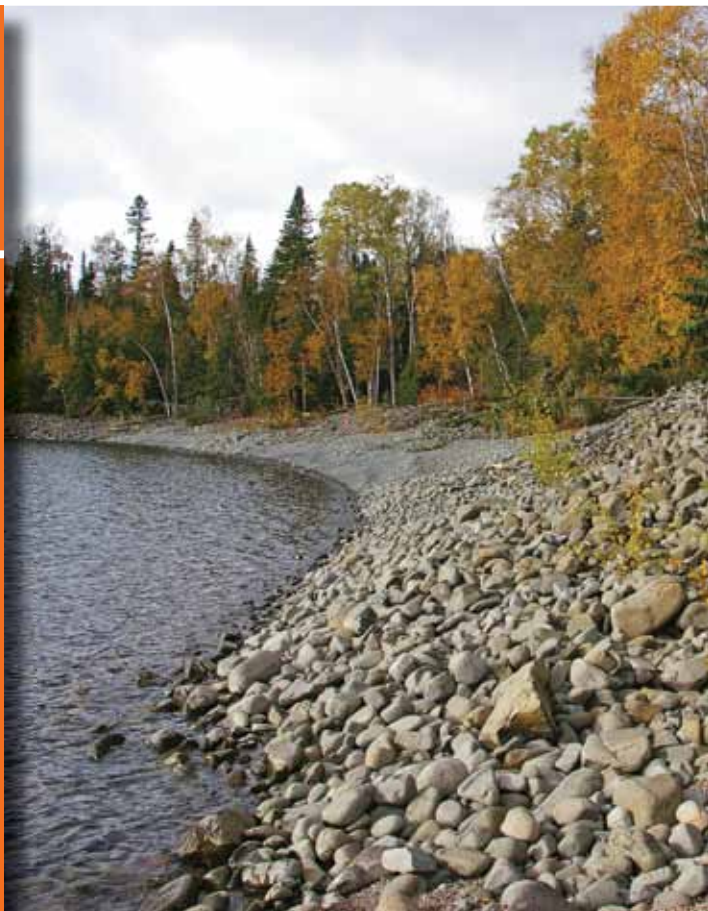
Participating schools will be promoted in the Sept. 2011 *GSA Today* (pending reservation submittal date), the 2011 Annual Meeting Program, and via e-mail links on the GSA Web site so prospective students may schedule appointments prior to the meeting.



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## 2011 Field Trips



*“Inherited” cobble beaches, Horseshoe Bay, Minnesota, USA.*

Early October is prime field season in the upper U.S. Midwest. As part of the 2011 GSA Annual Meeting & Exposition in Minneapolis, we are offering a diverse slate of 45 field trips (21 pre-meeting, 6 during the meeting, and 18 post-meeting) that span a geologically broad range of topics:

- The Precambrian geology of the southern Canadian Shield
- The economic geology of the Lake Superior region
- Phanerozoic strata in Minnesota, Wisconsin, Iowa, and North Dakota
- Glacial geology
- Hydrogeology and limnology
- Undergraduate and K–12 geoscience field education
- The geology and hydrology of the Twin Cities metro area
- Geology by bicycle
- “Wine geology” (terroir)
- Geoarchaeology
- Biogeochemistry
- Tours of area research labs and vessels



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## Find Your Science at GSA

### Associated Societies and Specialty Divisions

GSA's Annual Meetings bring the geoscience community together around the most current and cutting-edge research. GSA has a long tradition of collaborating with a wide range of partners in pursuit of the mutual goals of advancing the geosciences, enhancing the professional growth of our members, and promoting the geosciences in the service of humankind. GSA works with its 58 Associated Societies and 17 specialty Divisions to provide a rich Annual Meeting science program and related events. We invite you to submit your research, encourage other organizations to participate, and even hold your own events in Minneapolis in order to consolidate and minimize travel and meeting time for your members.

GSA's Specialty Divisions and Associated Societies are listed at [www.geosociety.org/divisions/](http://www.geosociety.org/divisions/).



### Recent, Rare, And Out-Of-Print Books



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### GSA Mentor Programs

Attend one or all of these mentor events and receive practical career advice from geoscience professionals.

#### Women in Geology:

Sun., 9 Oct.

(includes refreshments; all attendees invited)

#### Geology in Government:

Mon., 10 Oct.

(includes a FREE lunch for students)

#### Geology in Industry:

Tues., 11 Oct.

(includes a FREE lunch for students)

## 2011 Short Courses



*Learn and explore new topics and earn continuing education credits!*

**Course topics for professionals** include ground-penetrating radar imaging software, how to conduct radiological home inspections, and carbon capture and storage.

**Courses for faculty** include Gale, CRONUS-Earth On-Line Software, geophysics, J-DSP IESE Tools, Google Earth, ground based LiDAR, and GeoSci ML Data Services.

**Graduate students** will enjoy courses that address geographic information systems, sequence stratigraphy, seismic structural interpretation and stratigraphic concepts applied to basin exploration, and how to get a job in the applied geosciences.

**K-12 teachers** will learn hands-on inquiry-based geoscience activities for the classroom.

**Additional topics** span plate tectonics, three-dimensional geologic mapping, environmental magnetism, climate science, remote sensing, funding opportunities, conducting education research, preparing for tenure, and establishing undergraduate research programs.

Course descriptions and other details will be printed in the June *GSA Today* and posted online at [www.geosociety.org/meetings/2011/courses.htm](http://www.geosociety.org/meetings/2011/courses.htm).

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## REGISTRATION

Registration at [www.geosociety.org/meetings/2011/](http://www.geosociety.org/meetings/2011/) opens in early June.

**Early registration deadline:** 6 September

**Cancellation deadline:** 12 September

### FEES (all fees are in U.S. Dollars)

	Early June–6 Sept.		Standard/On-Site after 6 Sept.	
	Full Mtg.	One day	Full Mtg.	One day
Prof. Member	\$330	\$215	\$410	\$245
Prof. Member 70+	\$255	\$155	\$340	\$175
Prof. Nonmember	\$430	\$285	\$510	\$315
Student Member	\$109	\$70	\$144	\$80
Student Nonmember	\$149	\$90	\$184	\$100
High-School Student	\$40	n/a	\$40	n/a
K–12 Professional	\$50	n/a	\$60	n/a
Field Trip/Short Course only <sup>†</sup>	\$40	n/a	\$40	n/a
Guest or Spouse <sup>‡</sup>	\$85	n/a	\$90	n/a
Low Income Country <sup>§</sup>	50%	n/a	50%	n/a

GSA will provide each meeting registrant<sup>†</sup> with an electronic copy (CD-ROM) of the *Abstracts with Programs*, which includes the 2011 Section Meeting abstracts. The *Abstracts with Programs* book purchased along with meeting registration will be provided when you pick up your badge on-site.

<sup>†</sup>Field trip or short course only & guest or spouse registrants excluded.

<sup>§</sup>Participants from countries classified as “Low or Lower Middle Income Economies” by the World Bank need only pay 50% of their registration category fee for full-meeting or one-day registration. Registrants from these economies will not be able to register on-line, but a downloadable hard-copy version of the registration form will be available.



## GSA Student Travel Grants

GSA's Student Travel Fund will be available again this year to help student members attend the annual meeting.

Eligibility requirements will be posted online beginning in early June, and the online application form will be live at

[www.geosociety.org/meetings/2011/](http://www.geosociety.org/meetings/2011/) during the meeting registration period.

## International Section Travel Grants

**Application deadline:** 1 August 2011

GSA's International Section is offering travel grants again this to assist the participation of international scientists and students in the 2011 GSA Annual Meeting in Minneapolis, Minnesota, USA. Funds are limited; grants will not cover the full cost of attending the meeting but are intended to help defray the combined cost of registration, housing, and travel.

To apply, please go the GSA International Section's Web page at, [www.geosociety.org/sectdiv/International/travelGrants.htm](http://www.geosociety.org/sectdiv/International/travelGrants.htm). If you have questions, please contact Joann Stock, [jstock@gps.caltech.edu](mailto:jstock@gps.caltech.edu).





# ARCHEAN to ANTHROPOCENE

*the past is the key to the future*

## Information for International Attendees

Most travelers to the United States must hold a valid visa as well as a passport that is valid for six months longer than the intended visit. The visa application process may take several months.

### We Recommend...

1. Review your visa status, and find out if you need a U.S. visa or a renewal.
2. An interview appointment is required for visa application at all embassies and consulates. Visit the website of the embassy or consular section where you will apply for your visa to find out how to schedule an interview appointment, learn what fees you may need to pay, and find additional instructions.
3. The wait time for this appointment may be as long as three months (varies by location). Processing time may take an additional month or more. Check the U.S. State Department's website, [http://travel.state.gov/visa/temp/wait/wait\\_4638.html](http://travel.state.gov/visa/temp/wait/wait_4638.html), for specific wait times.
4. Most international visitors are required to have a complete set of fingerprints taken along with a digital photograph to verify identity at consulates as well as the port-of-entry. Canadians are currently exempt from this program.
5. Visitors from countries participating in the Visa Waiver Program must register in the Electronic System for Travel Authorization (ESTA) before entering the country. Check the U.S. State Department's website, [http://travel.state.gov/visa/temp/without/without\\_1990.html](http://travel.state.gov/visa/temp/without/without_1990.html), for more information.

## HOUSING

GSA's official housing bureau for this year's annual meeting is "Meet Minneapolis." Hotel reservations through Meet Minneapolis will open the first part of June.

GSA has reserved rooms at nine hotels within a seven-block area of the Minneapolis Convention Center. Convention rates are between US\$136 and US\$189 per night (single or double occupancy).

The headquarters hotel for this meeting will be the Hilton Minneapolis, where the majority of non-technical events will be held. The Hyatt Regency Minneapolis will serve as the co-headquarters hotel for additional events.

Room reservations will open up the first part of June. You will be able to make reservations through the GSA Annual Meeting website, [www.geosociety.org/meetings/2011/](http://www.geosociety.org/meetings/2011/), or by faxing or mailing the official GSA housing form to Meet Minneapolis. Look for details in the June *GSA Today*.

### Beware of "Housing Pirates"

"Housing Pirates" are unauthorized companies that phone, fax, or e-mail possible attendees and exhibitors, claiming to offer good deals on hotel rooms. They may falsely claim to be affiliated with GSA. Neither GSA nor Meet Minneapolis will telephone or send faxes offering special Minneapolis hotel rates. You will not be contacted directly by the GSA Housing Bureau/Meet Minneapolis unless there is a question about your existing reservation. For your protection, unless you have initiated the communication, please do not provide anyone with your personal information—especially your credit card number.

### GSA Appreciates Your Support in Booking within the Official GSA Hotel Block

In the event you have problems with your hotel reservation or accommodations, GSA can only assist in reconciling those issues if your reservation was booked through Meet Minneapolis. If you have questions about an unauthorized solicitation, the online system, or about housing in general, please contact Becky Sundeen, [bsundeen@geosociety.org](mailto:bsundeen@geosociety.org).

## GeoCorps™ America



Patrick Burns, U.S. Forest Service Frasier Experimental Forest, Summer 2010.

## Fall/Winter 2011–2012

**Application deadline: 1 July 2011**

This coming GeoCorps America fall/winter season runs from September 2011 through May 2012. All fall/winter 2011–2012 GeoCorps positions will be revealed on the GeoCorps website starting 1 May, when the program begins accepting applications.

GeoCorps provides paid, short-term geoscience opportunities on public lands managed by the National Park Service, the U.S. Forest Service, and the Bureau of Land Management. All levels of geologists—students, educators, professionals, retirees, and others—are encouraged to apply.

**Attention past GeoCorps participants**—GSA encourages you to consider presenting your GeoCorps work at a GSA Section Meeting or at the GSA Annual Meeting!

For details, go to

[www.geosociety.org/geocorps/](http://www.geosociety.org/geocorps/)

*Your Science, your colleagues, your society:  
Active participation makes a difference!*

---

**2012–2013 COMMITTEE VACANCIES**

**Nominations due:** 15 July 2011

**Terms begin** 1 July 2012 (unless otherwise indicated)

**Learn more at** [www.geosociety.org/aboutus/committees/](http://www.geosociety.org/aboutus/committees/) or contact Pamela Fistell, [pfistell@geosociety.org](mailto:pfistell@geosociety.org), +1-303-357-1044, +1-800-472-1988 ext. 1044.

---

**ARTHUR L. DAY MEDAL AWARD (T/E)**

**Two members-at-large vacancies (three-year terms)**

Selects candidates for the Arthur L. Day Medal Award.

**Qualifications:** Knowledge of those who have made “distinct contributions to geologic knowledge through the application of physics and chemistry to the solution of geologic problems.”

---

**DIVERSITY IN THE GEOSCIENCES (AM, T/E)**

**Three members-at-large vacancies (three-year terms)**

Provides advice and support to GSA Council for undertaking activities and initiates programs that will raise opportunities and awareness in the geosciences community of the positive role that people of an ethnic minority, women, and people with disabilities play within the geosciences. Stimulates recruitment and promotes positive career development.

**Qualifications:** Familiarity with the employment issues faced by minorities, women, and people with disabilities; expertise and leadership experience in such areas as human resources and education is desired.

---

**COMMITTEE ON EDUCATION (AM, B/E, T/E)**

**One undergraduate student representative vacancy (two-year term)**

Committee members represent a wide range of education sectors and focus on the development of informal, pre-college (K–12), undergraduate, and graduate earth-science education and outreach objectives and initiatives. **Qualifications:** Ability to work with other interested scientific organizations and science teachers’ groups.

---

**GEOLOGY AND PUBLIC POLICY (AM, B/E, T/E)**

**Two members-at-large vacancies (three-year terms) and one student representative vacancy (two-year term)**

Provides advice on public policy matters to GSA Council and leadership; monitors and assesses international, national, and regional science policy; formulates and recommends position statements and sponsors topical white papers; and encourages the active engagement of GSA members in geoscience policy. **Qualifications:** Experience with public-policy issues involving the science of geology; ability to

develop, disseminate, and translate information from the geologic sciences into useful forms for the general public and for GSA Members; and familiarity with appropriate techniques for the dissemination of information.

---

**JOINT TECHNICAL PROGRAM COMMITTEE (T/E)**

**One paleoceanography/paleoclimatology representative vacancy and one Precambrian geology representative vacancy (three-year terms begin 1 Dec. 2011)**

Assists in finalizing the annual meeting technical program; participates in the Web-based selection and scheduling of abstracts; and participates in topical session proposal review.

**Qualifications:** Must be familiar with computers and the Web, be a specialist in one of the specified fields, and be available in late July through mid-August for the organization of the technical program.

---

**MEMBERSHIP (B/E)**

**One member-at-large (government) vacancy (three-year term)**

Contributes to the growth of GSA membership and attends to members’ changing needs; focuses on attracting and retaining students, professionals working in industry, and those studying and working outside the United States; reviews and makes recommendations for Fellowship to Council.

**Qualifications:** Experience with benefit, recruitment, and retention programs is desired.

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**NOMINATIONS (B/E, T/E)**

**Two members-at-large vacancies (three-year terms)**

Recommends nominees to GSA Council for the positions of GSA Officers and Councilors, Committee members, and Society representatives to other permanent groups.

**Qualifications:** Familiarity with a broad range of well-known and highly respected geological scientists.

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**PENROSE CONFERENCES AND FIELD FORUMS (T/E)**

**Two members-at-large vacancies (three-year terms)**

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

---

**PENROSE MEDAL AWARD (T/E)**

**Two members-at-large vacancies (three-year terms)**

Selects candidates for the Penrose Medal Award; emphasis is placed on “eminent research in pure geology, which marks a

major advance in the science of geology.” **Qualifications:** Familiarity with outstanding achievers in the geosciences who are worthy of consideration for the honor.

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#### PROFESSIONAL DEVELOPMENT (T/E)

##### **One member-at-large vacancy (three-year term)**

Directs, advises, and monitors GSA’s professional development program; reviews and approves proposals; recommends and implements guideline changes; and monitors the scientific quality of courses offered.

**Qualifications:** Familiarity with professional development programs and/or adult education teaching experience.

---

#### RESEARCH GRANTS (B/E)

##### **Six members-at-large vacancies (three-year terms)**

Evaluates student research grant applications and selects grant recipients. **Qualifications:** Should have experience in directing research projects and in evaluating research grant applications. *Extensive time commitment required 15 Feb.–15 Apr. 2012.*

---

#### YOUNG SCIENTIST AWARD (DONATH MEDAL) (T/E)

##### **Two members-at-large vacancies (three-year terms)**

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

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#### GSA REPRESENTATIVES TO OTHER ORGANIZATIONS

##### **GSA Representative to the AGI Environmental Geoscience Advisory Committee (EAGC)**

##### **One vacancy (three-year term begins 1 Jan. 2012)**

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

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#### NORTH AMERICAN COMMISSION ON STRATIGRAPHIC NOMENCLATURE (NACSN) (AM, POSSIBLY B/E)

##### **One vacancy (three-year term begins 1 Nov. 2012)**

Develops statements of stratigraphic principles; recommends procedures applicable to classification and nomenclature of stratigraphic and related units; reviews problems in classifying and naming stratigraphic and related units; formulates expressions of judgment on these matters.

---

#### U.S. NATIONAL COMMITTEE FOR SOIL SCIENCE (USNC/SS)

##### **One vacancy (three-year term begins 1 July 2012)**

The mission of the USNC/SS is to promote the advancement of soil science in the United States and throughout the world

in order to strengthen U.S. soil science as a contributor to the international scientific community and to inform the U.S. scientific community of soil science activities carried out elsewhere in the world. As such, it works to promote and facilitate participation of all U.S. soil scientists in the IUSS.

**Qualifications:** Should be a soil scientist and GSA member.

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#### COMMITTEE, SECTION, AND DIVISION VOLUNTEERS:

### *Council Thanks You!*

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

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## NOTICE of Spring 2011 GSA Council Meeting



Meetings of the GSA Council are open to Fellows, Members, and Associates of the Society, who may attend as observers, except during executive sessions. Only councilors and officers may speak to agenda items, except by invitation of the chair.

Council will meet next on Friday, 29 April, 1–4:30 p.m.; Saturday, 30 April, 8 a.m.–noon; and Monday, 2 May, 8 a.m.–noon. The GSA corporate meeting will be Friday, 29 April, 4:30–5 p.m. Meeting location: TBA.



The Geological Society of America  
3300 Penrose Place, P.O. Box 9140,  
Boulder, CO 80301-9140, USA  
+1-303-357-1000, option 3, or +1-888-443-4472

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AM—Meets at the Annual Meeting • B/E—Meets in Boulder or elsewhere • T/E—Communicates by phone or electronically



**CALL FOR NOMINATIONS**

# 2011 GSA DIVISION AWARDS

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**GSA History and Philosophy of Geology Division**

**HISTORY AND PHILOSOPHY OF GEOLOGY STUDENT AWARD**

**Applications due** 3 May 2011

This award applies to student GSA Annual Meeting paper proposals based on the following topics: (1) the history of geology; (2) a literature review supporting ideas for technical work or a thesis/dissertation; and/or (3) some imaginative aspect of the history and philosophy of geology not previously brought to light. Consideration will be given to both undergraduate and graduate students who are in good standing at the time of application; the presentation may take place after the student has graduated. Applicants need not be GSA members or members of the History and Philosophy of Geology Division. Students must be lead authors on the paper and, while both oral and poster presentations are acceptable, oral presentations are preferred. Further guidelines and the application form are online at <http://gsahist.org/HoGawards/awards.htm>. *Questions?* Contact the Division secretary-treasurer, **Jane P. Davidson**, at [jdhexen@unr.edu](mailto:jdhexen@unr.edu).

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**GSA Limnogeology Division**

**KERRY KELTS STUDENT RESEARCH AWARDS**

**Applications due** 2 August 2011

The Kerry Kelts Research Awards of the Limnogeology Division recognize undergraduate or graduate student research excellence and are named in honor of Kerry Kelts, a visionary limnogeologist and inspiring teacher. This year, one award of US\$1,000 for research related to limnogeology, limnology, or paleolimnology is being offered. To apply, send a summary of the proposed research, its significance, and how the award will be used (five-page max. PDF) along with your name and a

short CV (two-page max. PDF) to the Division chair, **Daniel M. Deocampo**, [deocampo@gsu.edu](mailto:deocampo@gsu.edu).

GSA hopes to increase the number of the awards in succeeding years, and membership dues help with this important Division activity. Please be sure to join or renew your Division membership, and if you are interested in supporting this awards program more substantially, please send your donations, designated for the Kerry Kelts Research Awards of the Limnogeology Division, to GSA Grants, Awards & Recognition, P.O. Box 9140, Boulder, CO 80301-9140, USA.

.....

**GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division**

**DISTINGUISHED GEOLOGIC CAREER AWARD**

**Nominations due** 15 April 2011

This new MGPV Division award will go to an individual who, throughout his/her career, has made distinguished contributions in one or more of the following fields of research: mineralogy, geochemistry, petrology, volcanology, with emphasis on multidisciplinary, field-based contributions. Nominations are solicited from the MGPV Division membership at large. Nominees need not be citizens or residents of the United States, and GSA membership is not required. Recognition includes a wall plaque and US\$1,000.

Send (1) a one- to two-page letter summarizing the nominee's most important accomplishments in geologic approaches to mineralogy, geochemistry, petrology, and/or volcanology, paying special attention to describing how the nominee's published work demonstrates field-based multidisciplinary geologic accomplishments of a groundbreaking nature; (2) the nominee's CV; and (3) three letters of support, which can be from non-members as well as members of GSA and/or the MGPV Division to the Division secretary-treasurer, **J. Alex Speer**, [jaspeer@minsocam.org](mailto:jaspeer@minsocam.org)

## GSA ON THE WEB

**Website:**

[www.geosociety.org](http://www.geosociety.org)

[www.geosociety.org/community/](http://www.geosociety.org/community/)

**Jobs RSS Feed:**

[www.geosociety.org/classiads/](http://www.geosociety.org/classiads/)

**E-news magazine:**

[www.geosociety.org/GSA\\_Connection/](http://www.geosociety.org/GSA_Connection/)



**Blog: Speaking of Geoscience:**

<http://www.geosociety.wordpress.com/>



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# GSA Foundation Update

Geoff Feiss, GSA Foundation President

## Sustaining The Work of The Geological Society of America

When the Geological Society of America (GSA) moved to Colorado from New York in 1968, issues of environmental sustainability and reducing one's environmental footprint were far from front-page news. Today, they are, and GSA has begun to make progress toward bringing the headquarters building at 3300 Penrose Place, Boulder, Colorado, USA—built in a different time under a different set of assumptions—into the twenty-first century with respect to lessening our environmental impact.

### WHY SHOULD GSA RESPOND TO THESE CHANGING TIMES?

GSA's logo highlights our commitment to "Science ■ Stewardship ■ Service." GSA Council embraced stewardship as a major focus of society programs in our mission and vision statements (see [www.geosociety.org/aboutus/](http://www.geosociety.org/aboutus/)). And, even if husbanding Earth's resources were not important in its own right, Council has made prudent and diligent control of expenditures a top priority (see GSA Strategic Plan Goal 7B, [www.geosociety.org/aboutus/stratplan.htm](http://www.geosociety.org/aboutus/stratplan.htm)).

### Stewarding Earth's Resources at GSA Headquarters

For GSA's leadership, a commitment to Earth stewardship begins at home. We have looked carefully at the resource demands of GSA's Boulder headquarters operations. New business practices and infrastructure modifications are beginning to bear fruit as significant reductions in GSA's consumption of resources and as real savings in the Society's operating costs.

To lessen our environmental impact, we are recycling, reducing the consumption of resources, and reducing dependency on nonrenewable energy sources. Each of these reductions in resource consumption saves money, which is redirected to the Society's mission of supporting the geosciences.



### What Have We Done to Date?

First, we have changed our patterns of behavior: (1) we use more natural light; (2) close blinds at night in the winter and in the full sun of summer; (3) turn down thermostats in winter and raise them in summer; (4) replaced incandescent lights with compact fluorescent and halogen bulbs; (5) installed timers and motion sensors on light fixtures; (6) turn off devices when not in use; (7) and installed modern, zonal HVAC controls. These and other changes have reduced GSA's energy consumption by 30% for natural gas and by 29% for electrical power (a decrease of 113,000 kilowatt hours).

GSA headquarters occupies 4.5 acres of land in northeast Boulder. As every geologist, beginning with John Wesley Powell, knows, water is a scarce resource west of the hundredth meridian. With this in mind, we have reduced water consumption for irrigation by 31%, or 424,000 gallons. Plans to xeriscape GSA's property will likely reduce water demand to near zero, saving another 950,000 gallons of water per year.

**Support GSA Programs**  
**Donate now!**



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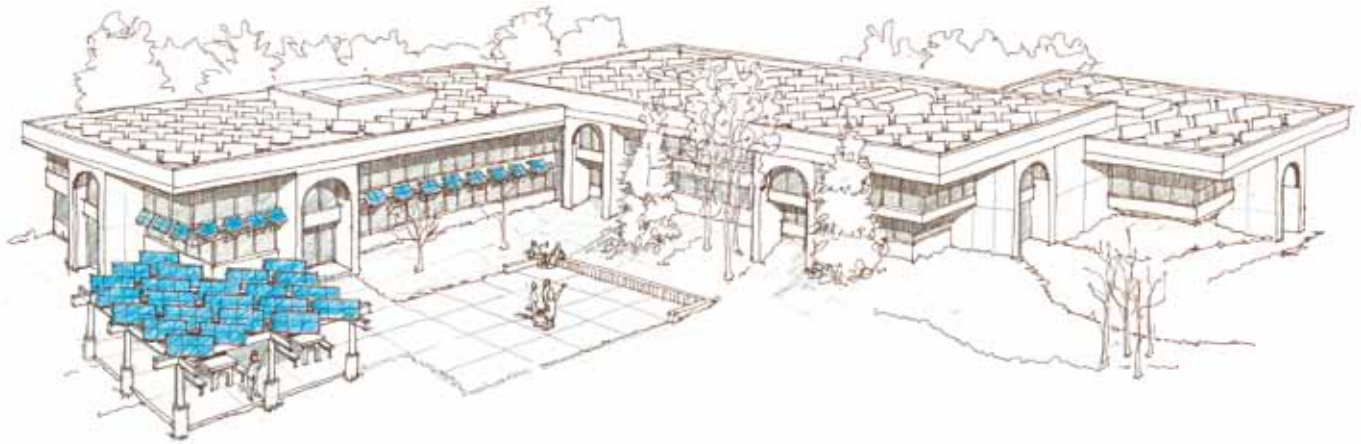
Phone \_\_\_\_\_



4 Mail to:

GSA Foundation  
P.O. Box 9140  
Boulder, CO 80301

Donate online at [www.gsafweb.org](http://www.gsafweb.org)



Artist's rendition: Phase I completion Oct. 2010. Phase II shows in blue.

Internal water consumption has been reduced by 37%, saving another 120,000 gallons of water per year. Using newly acquired funds from the GSA Building Fund (see next section), new plumbing fixtures are being installed that will reduce this consumption by another 90,000 gallons, for a 65% overall reduction.

GSA staff recycle, compost, and host zero-waste events that have diverted 80% of our office waste from the landfill. We set the ambitious goal of being a zero-waste facility (90% reduction in trash to the landfill) in 2011.

In April 2009, a group of GSA staff broke ground on a portion of GSA HQ land to create a cooperative garden. It is hard to quantify the garden's environmental impact, but it is certain that it reduces the consumption of resources used in packaging, transportation, and production of fruits and vegetables relative to purchases made at local stores.

Along with all this, as of 2011, GSA is now using 100% renewable energy to provide electrical energy for all headquarters operations. This major accomplishment requires some elaboration.

### Getting to 100% Renewable Energy Sources for Electrical Power

In November 2010, GSA threw the switch on its solar energy "farm," consisting of 298 high-efficiency PVC panels on the flat roof of the headquarters building. These panels will produce 90,000 kilowatt hours per year, with an estimated 20-year life expectancy. Colorado's local energy provider, Xcel Energy, has given GSA renewable energy credits (RECs) of US\$10,000 per year for the next twenty years, to be invested in a newly created GSA Energy Fund held in the GSA Foundation for future renewable energy projects and maintenance and future replacement of the system.

This project was a collaboration with the City of Boulder Climate Smart Program, which awarded GSA a grant of US\$30,000, and Xcel Energy, which, in addition to the RECs, provided US\$134,000 in direct rebates. Our installation contractor, Bella Energy, worked as a partner, assisting us by coming in on-budget and on-deadline. The net result is that the system will fully pay for itself in seven years—about one-third the life of the system.

The balance of the capital funds were generated by allowing a City of Boulder floodplain easement on the south side of

GSA's property. A much-depreciated, older home—no longer used by GSA and of no historical value—was sold to the city when the easement was granted. The funds generated allowed completion of the rooftop system, with the balance placed into the GSA Foundation's Building Fund.

The 90,000 kWh/a generated by our new solar "farm" will cut GSA's annual electrical demand from the grid by 35%. In addition, we have reduced our non-renewable electrical consumption to zero by the purchase of wind-generated energy through Xcel Energy's Windsource program.

### The Future—More Solar and Outreach

GSA's goal is to increase our solar energy production and reduce the purchase of wind power by about half. This is our Phase II Solar Project.

The Phase II project involves the installation of an additional 192 solar panels (generating an estimated 50,000 additional kilowatt hours per year) on the south side of headquarters building to shade south-facing windows, as well as the installation of a solar awning for summer shade over the Eaton Terrace. Funding for this project will come from a combination of grants, rebates, transfers from the Foundation's Energy Fund, and private contributions. With respect to the latter, the Foundation has launched a campaign to engage our members and friends in an opportunity to purchase Phase II PV panels at US\$1000 apiece. Each panel will be identified and each donor will be able to monitor his/her panel's energy production online. If you are interested in participating, please contact Anna Christensen at [achristensen@geosociety.org](mailto:achristensen@geosociety.org) or +1-303-357-1007.

GSA is also partnering with the American Solar Energy Society (ASES; [www.ases.org](http://www.ases.org)), headquartered in Boulder, on educational and outreach opportunities arising with the Phase II project. With more than 13,000 members, ASES is the leading association of solar energy professionals and advocates.

Finally, as the City of Boulder reclaims GSA's floodplain easement, the opportunity arises to set up a geology-related educational exhibit on the bike path that is to be built on the floodplain. This will be an opportunity for the society to be better known to Boulderites who use such bike and footpaths regularly.

## GEOHERITAGE

GSA members are invited to submit comments and suggestions regarding the following *Position Statement draft* by **16 May 2011** at [www.geosociety.org/geopolicy/](http://www.geosociety.org/geopolicy/). Go to [www.geosociety.org/positions/](http://www.geosociety.org/positions/) to learn more.

**Position Statement:** The Geological Society of America (GSA) supports the conservation of geoh heritage sites to meet present and future educational, scientific, aesthetic, cultural, and economic needs.

**Purpose:** This position statement (1) summarizes the consensus views of GSA on the conservation of geoh heritage sites; (2) describes what geoh heritage sites are and why they are important; (3) endorses U.S. participation in the Global Network of National Geoparks supported by UNESCO; and (4) advocates development of partnerships and strategies for conserving geoh heritage sites.

### RATIONALE

“Geoh heritage” is a generic but descriptive term applied to sites or areas of geologic features with significant scientific, educational, cultural, or aesthetic value. *Scientifically and educationally significant geoh heritage sites* include those with textbook geologic features and landscapes, distinctive rock or mineral types, unique or unusual fossils, or other geologic characteristics that are significant to education and research. *Culturally significant geoh heritage sites* are places where geologic features or landscapes played a role in cultural or historical events. *Aesthetically significant geoh heritage sites* include landscapes that are visually appealing because of their geologic features or processes. Many geoh heritage sites can be tourist destinations and provide local and regional economic benefits.

Geoh heritage sites serve the public interest. Such sites are critical to advancing knowledge about natural hazards, groundwater supply, soil processes, climate and environmental changes, evolution of life, mineral and energy supplies, and other aspects of the nature and history of Earth. Such sites have high potential for scientific studies, use as outdoor classrooms, enhancing public understanding of science, recreation, and economic support to local communities.

Geoh heritage sites can be small but scientifically significant sites, such as a road cut, or named and managed sites of a few acres, such as Boiling Springs (a groundwater site of two acres in Cumberland County, Pennsylvania, USA). Geoh heritage sites can also be extensive areas with international recognition, such as the Grand Canyon (Arizona, USA) and Yellowstone

National Park (Wyoming, USA). Geoh heritage sites may be on privately owned land, on land in public ownership ranging from municipalities to the federal government, or on land of mixed ownership. Large or small, and regardless of ownership, many are vulnerable to urbanization, infrastructure development, agriculture, over-use, or erosion. Conservation strategies appropriate to the type of site and nature of ownership are important to protect geoh heritage sites from loss and maintain them for the long-term public interest.

### PUBLIC POLICY ASPECTS

Geoh heritage sites in the United States include officially designated sites and areas with a high level of distinct conservation management, such as National Parks, National Monuments, World Heritage Sites, National Historic Landmarks, and National Natural Landmarks. Many of these areas were designated because of their special geologic features, geologic history, or a unique combination of both. Federal land management agencies, such as the National Park Service (NPS), Bureau of Land Management (BLM), and U.S. Forest Service, manage these sites to conserve their special features and characteristics for future generations. Through the public land management planning process, federal land management agencies also designate and apply conservation management objectives to other significant sites that in many cases have values related to geology.

Some geoh heritage sites, including those that may span different types of land ownership, are particularly significant based on unique and outstanding geologic characteristics and cultural history. Such sites may be suitable for inclusion in the Global Network of National Geoparks, supported by UNESCO. “Geopark” is an international designation serving to integrate the preservation of significant examples of geologic heritage within a strategy for sustainable and cultural development at a regional scale. None of the 77 Geoparks designated worldwide are in the United States. Geoh heritage sites with Geopark designation provide opportunities for geotourism, interpretation, research, connecting people to the landscape, and sustaining local economies<sup>1</sup>.

Partnerships among state agencies, counties, municipalities, non-profit organizations, businesses, and other private parties can lead to innovative approaches to conserving geoh heritage sites on other types of publicly owned lands and, in some cases, private lands. Such efforts will ensure that even small geoh heritage sites can be preserved in perpetuity and managed for the use, enjoyment, and scientific advancement of future generations. Geoh heritage conservation efforts can also result in a sustainable source of tourism income for communities.

<sup>1</sup>Hill, Wesley, 2010, UNESCO’s Geoparks Initiative—Education, Conservation, Geotourism: Geological Society of America Abstracts with Programs, v. 42, no. 5, p. 662.





Horseshoe Bend, Colorado River, USA.

## RECOMMENDATIONS

- *Recognize and support designation and appropriate management of geoh heritage sites.* By definition, all sites with some sort of geoh heritage designation have scientific, educational, aesthetic, or cultural value based on geologic characteristics. All such sites are not only scientifically important, but also offer the potential for supporting local and regional economies through tourism. Governing bodies, particularly those at a local level, can play a key role in conserving geoh heritage sites for the public benefit.
- *Encourage collaboration and partnerships to identify, designate, and manage geoh heritage sites.* Collaboration among the geologic community, local and regional governments, and private interests can be most effective in promoting appropriate designations and management strategies for both existing geoh heritage sites and areas in need of geoh heritage designation and management. Partnerships will ensure that designation and management of geoh heritage sites benefit both the broader community and a variety of interests and needs.
- *Support U.S. participation in UNESCO's Global Network of National Geoparks.* The formation of a U.S. National Committee for Geoparks under the auspices of the U.S. National Commission for UNESCO will further U.S. participation in the Geoparks network. In addition, the development of U.S. guidelines for Geoparks applications involving appropriate public and private interests will help streamline the application process and enhance the potential for U.S. Geopark designations. Geopark status not only ensures conservation of significant geologic features, but also gains worldwide recognition and provides scientific, educational, economic, and cultural benefits to local communities.
- *Respect and honor the needs and interests of private landowners with special geologic features on their land.* All or parts of some geoh heritage sites may be on private

land. GSA and its membership recognize and respect the autonomy of private land owners. All actions taken in response to this position statement must fully and respectfully accommodate the rights and desires of private land owners.

## OPPORTUNITIES FOR GSA AND GSA MEMBERS TO HELP IMPLEMENT RECOMMENDATIONS

To facilitate implementation of the goals of this position statement, The Geological Society of America recommends that its members take the following actions:

- *Seek opportunities to communicate the value of geoh heritage sites to decision makers and the public.* Legislative bodies, government agencies, private developers, economic development corporations, professional land-use planners, chambers of commerce, professional forums, town hall meetings, and community groups all provide avenues for expanding knowledge of the value of geoh heritage sites. Use examples of how management of a geoh heritage site has added value to land-use planning, advanced understanding of geologic processes and potential for hazards, and/or contributed to economic growth. Use examples of how overlooking geoh heritage has resulted in costly and damaging land use, devastating consequences of natural disasters, or loss of tourist and tax revenues. An informed public can be a powerful force in identifying and designating geoh heritage sites and collaborating on long-term management strategies.
- *Initiate designation of or management strategies for a site in need of preservation.* Identify other parties that may benefit from designation of a site or enhanced management of an existing designated site. Promote collaboration and partnerships for determining appropriate designation (e.g., from local park to Geopark), developing management objectives, and sharing costs. Identify benefits for various interests, such

as the educational value for local secondary schools, research value for the geologic community or local planners, aesthetic value for outdoor enthusiasts, and economic value through tourism and local users.

- *Utilize print, electronic, and broadcast media in promoting the value of geoh heritage designations.* When appropriately utilized, the media are effective and efficient communication tools in addressing critical issues associated with geoh heritage conservation. If you are uncertain about how to make contact and work with the media, seek assistance and advice from other GSA members with that experience.
- *Be alert to local, state, and federal legislation and policy development relevant to geoh heritage or for designation of specific sites.* Get involved by offering expert assistance, commenting, contacting decision makers, sharing this position paper, or soliciting additional expertise. Seek advice from and share information about geoh heritage with GSA's Geology and Public Policy Committee (GPPC), GSA's Geology and Society Division, and GSA's Director for Geoscience Policy in Washington D.C.
- *Propose symposia, technical sessions, and workshops on geoh heritage issues at GSA Annual and Sectional meetings.* Sharing experiences, successes, and challenges with geoh heritage designations and management will help others in the geoscience community be more effective in their efforts to preserve geoh heritage sites for future generations.

- *Develop educational materials about geoh heritage.* Descriptive and explanatory documents, including drawings and pictures, would be helpful to interested parties for handouts, signage, websites, field trips, and communicating with decision and policy makers, and site managers.

## REFERENCES AND RESOURCES

- Earth Sciences for Society, <http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/geoparks/>. This UNESCO site defines Geoparks and provides links to related information.
- Geoh heritage, Springer.com, <http://www.springer.com/earth+sciences+and+geography/geology/journal/12371>. This journal covers all aspects of geoh heritage and its protection.
- Global Geoparks Network, [http://portal.unesco.org/science/en/ev.php-URL\\_ID=7384&URL\\_DO=DO\\_TOPIC&URL\\_SECTION=201.html](http://portal.unesco.org/science/en/ev.php-URL_ID=7384&URL_DO=DO_TOPIC&URL_SECTION=201.html). This site provides a link (English or French) to a 6-page brochure defining "Geopark," describing the Global Geoparks Network, explaining the relationship between the Global Geoparks Network and UNESCO, and laying out a strategy for geoconservation in the context of regional economic and cultural development.
- Global Network of National Geoparks (assisted by UNESCO), <http://www.globalgeopark.org/publish/portal1/tab59/>. This site provides a definition of "Geoparks," lists members of the Geoparks Network, provides information about and photos of the 77 designated Geoparks worldwide, and offers news about Geoparks.
- Join the Geoh heritage Movement, About.com:Geology, [http://geology.about.com/od/geoh heritage/Join\\_the\\_Geoh heritage\\_Movement.htm](http://geology.about.com/od/geoh heritage/Join_the_Geoh heritage_Movement.htm). This site features articles (links) about geoh heritage, geoh heritage sites, geoconservation, world heritage sites, Geoparks, and geology-related forums.

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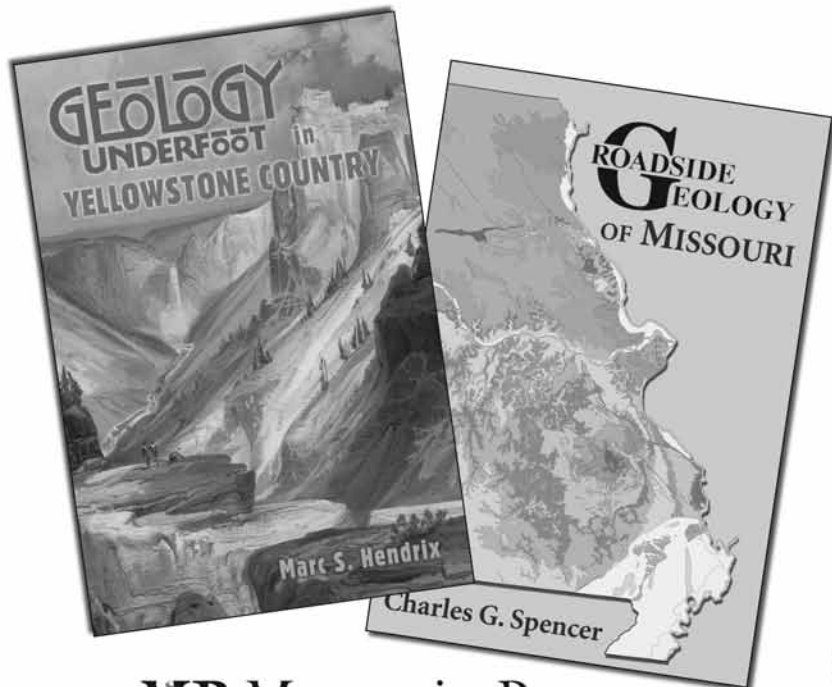
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## About People

January 2011: GSA Member **Steven A.F. Smith** has been awarded the Ramsay Medal for his paper "Interactions between low-angle normal faults and plutonism in the upper crust: Insights from the Island of Elba, Italy (*GSA Bulletin*, v. 123 no. 1–2 p. 329–346, doi: 10.1130/B30200.1). The Medal is awarded to the best paper published by a post-graduate based on his or her doctoral thesis work and is open to candidates worldwide. It is one of the premier postgraduate research awards in Europe.

January 2011: GSA Fellow **Stan Totten** has been honored with the Hall of Fame award from the Ohio Dept. of Natural Resources for his many contributions to understanding Ohio's geology. Learn more at <http://woostergeologists.scotblogs.wooster.edu/2011/01/25/dr-stan-totten-58-receives-a-hall-of-fame-award-from-the-ohio-department-of-natural-resources/>.

December 2010: GSA Fellow **David Walker** has received the AGU's 2010 Harry H. Hess Medal for his outstanding achievements in research of the constitution and evolution of Earth and other planets. Learn more at <http://blogs.ei.columbia.edu/2010/12/15/honoring-a-pioneer-in-planetary-evolution/>.

## Coming to GSA Today in 2011

### Science Articles

**June:** P. Hammer, R. Clowes, F. Cook, K. Vasudevan, and A. van der Velden, "The big picture: A lithospheric cross section of the North American continent"

**July:** P. Reiners, C. Riihimaki, and E. Heffern, "Clinker geochronology, Plio-Pleistocene glaciation, and landscape evolution in the northern Rockies"

### Groundwork articles:

**In the queue:** S. O'Connell and M.A. Holmes, "Obstacles to the recruitment of minorities into the geosciences"

**In the queue:** J. Libarkin, E.G. Ward, S. Anderson, G. Kortemeyer, and S. Raeburn, "Revisiting the geoscience concept inventory: A call to the community"

GSA Today articles from 1995 on are open access via link at [www.geosociety.org/pubs/](http://www.geosociety.org/pubs/).

## Classified Rates—2011

Ads (or cancellations) must reach the GSA advertising office no later than the first of the month, one month prior to the issue in which they are to be published. Contact [advertising@geosociety.org](mailto:advertising@geosociety.org), +1.800.472.1988 ext. 1053, or +1.303.357.1053. All correspondence must include complete contact information, including e-mail and mailing addresses. To estimate cost, count 54 characters per line, including punctuation and spaces. Actual cost may differ if you use capitals, bold-face type, or special characters. Rates are in U.S. dollars.

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## Positions Open

### COLLEGE OF SCIENCE, HEALTH & ENGINEERING LECTURER, DEPT. OF GEOLOGY EASTERN WASHINGTON UNIVERSITY

Recruitment Date: March–April 2011

Eastern Washington University and the Dept. of Geology invite applications for one-year Lecturer position to begin September 2011. The Dept. of Geology offers BA and BS degrees in Geology, as well as a dual degree program in Geology and Environmental Science and a BAE degree for Earth Science Teachers.

#### Qualifications & Requirements:

- Preference given to candidate with Ph.D. in Geology or a related discipline;
- Preference given to candidate who offers expertise in Structural Geology;
- Demonstrated potential for excellence in teaching in area of specialization and core geology courses; and
- Demonstrated high degree of interest, ability and/or experience promoting cultural competency and/or diversity

Responsibilities will include teaching introductory geology, structural geology, and other courses depending on Dept. al needs.

Review of applications will begin after 3 April 2011; preference will be given to applications received by 10 May 2011; position is open until filled. To be considered for this opportunity, please submit your application materials through our online faculty application portal (located at <https://jobs.hr.ewu.edu>). Submittals must include a letter of application, which addresses each of the qualifications; curriculum vitae; three letters of reference; evidence of your teaching; and evidence of your research and professional activity. You will also be asked to complete a short candidate profile form as part of the online process. Applications will not be accepted via email or regular mail.

Eastern Washington University is committed to increasing the diversity of its faculty, staff, students and academic program offerings and to strengthen sensitivity to diversity throughout the institution. We are an affirmative action/equal opportunity employer, and applications from members of historically underrepresented groups are especially encouraged to apply. Successful candidate(s) will be required to pass a background check and show proof of eligibility to work in the U.S. pursuant to U.S. immigration laws. Special accommodations: Eastern strives to satisfy all requests for special access needs for persons with disabilities. Requests for such accommodations are welcome and may be made by calling Human Resources at +1-509-359-2381. For additional information about the position, please visit <http://access.ewu.edu/HRRR/Jobs.xml>. Questions about the position may also be directed to the Dept. of Geology at +1-509-359-2286.

### INVERTEBRATE PALEONTOLOGIST 3-YEAR VISITING POSITION ST. LAWRENCE UNIVERSITY

St. Lawrence University seeks a broadly trained Invertebrate Paleontologist to teach courses that document the development of life on our planet including its paleobiology, stratigraphy, paleoecology and

taphonomic processes. The successful candidate for this 3-year visiting assistant professor position must have a Ph.D. in Paleontology with a background in systematics and morphology, a demonstrated interest in field studies, and the ability and intent to develop a specimen-based teaching/research program enhanced by interaction with students and colleagues. Teaching responsibilities will include the major core course Invertebrate Paleontology, and elective courses in the candidate's area of interest such as Paleocology, Micropaleontology, Dinosaurs, and Basin Analysis. We are particularly interested in someone who can develop one or more general education courses emphasizing the evolution and history of life on Earth that reflect the diversity and applications of the fossil record and the interface between Geology and the other Natural Sciences. Mentoring senior honors theses and independent projects based on original research is part of the normal teaching load and is essential to our program. Core and elective courses should include a field component and should encourage students to consider specimen-based research across the broad range of the Earth's fossil record. Our program in Paleontology is supported by a diverse fossil collection, by a well equipped paleontological laboratory, SEM, EDAX, Cathodoluminescence and X-ray equipment and by four colleagues with interdisciplinary research interests.

Candidates interested in the position and who meet these basic requirements should forward: (1) a statement describing their teaching philosophy and research interests; (2) a complete curriculum vitae; and (3) three letters of recommendation from professionals who both know the candidate well and who understand the expectations of a competitive liberal arts college.

Application materials should be submitted to Dr. Anton Husinec, Chair, Paleontologist Search, Geology Dept., St. Lawrence University, Canton, NY 13617. Review of applications will begin on 1 April 2011 and continue until the position is filled.

St. Lawrence is a private, liberal arts college in a rural setting in northern New York. The Geology Dept. has a nationally recognized program which emphasizes broad training in geosciences and abilities to synthesize and communicate. An active Geology Club and chapter of the Earth Science Honor Society, Sigma Gamma Epsilon, encourage students to undertake professional activities at the local and national levels. For additional information, please visit SLU's homepage at [www.stlawu.edu](http://www.stlawu.edu). SLU is an Affirmative Action/Equal Employment Opportunity employer. Women, minorities, veterans, and persons with disabilities are encouraged to apply.

### DIRECTOR NEW MEXICO BUREAU OF GEOLOGY & MINERAL RESOURCES

The New Mexico Bureau of Geology and Mineral Resources is seeking a new director and state geologist. The bureau is a research and service division of the New Mexico Institute of Mining and Technology (New Mexico Tech), located in Socorro, New Mexico. With close to 60 employees, the bureau serves as the state geological survey, with a long-standing reputation for excellence in research, service, and outreach. Our mission includes research on the geologic framework of the state, with an emphasis on applied geosciences and the state's geologic resources; and the gathering, preservation, and dissemination of geologic information to the geoscience community, state and federal agencies, and the general public. The director manages the administrative, personnel, and financial affairs of the bureau, including direct supervision of a significant portion of the professional staff, and must be proactive in seeking additional, external funding to support new and ongoing programs. As a division of the university, the bureau works in collaboration with other divisions of the university. The director reports directly to the university president. As state geologist, the director serves on several state advisory commissions. Requirements include a Ph.D. in the geosciences, ten years of professional experience, and five years of administrative experience. Anticipated appointment date: 1 July 2011. Salary: Negotiable. Full details of the position and information regarding application procedures may be found at [www.geoinfo.nmt.edu/DirectorSearch](http://www.geoinfo.nmt.edu/DirectorSearch) and at [www.nmt.edu/hr-jobs-at-nmt](http://www.nmt.edu/hr-jobs-at-nmt). For more information about the application process, contact JoAnn Salome in Human Resources at +1-575-835-5955 ([JSalome@admin.nmt.edu](mailto:JSalome@admin.nmt.edu)). For more information about the position itself, contact L. Greer Price, search committee chair, at +1-575-835-5752 ([gprice@gis.nmt.edu](mailto:gprice@gis.nmt.edu)). For full consideration, application materials must be received by 15 May 2011.

### JACKSON POSTDOCTORAL FELLOWS PROGRAM JACKSON SCHOOL OF GEOSCIENCES THE UNIVERSITY OF TEXAS AT AUSTIN

The Jackson School of Geosciences (JSG) at the University of Texas at Austin announces a new school-wide postdoctoral fellows program and invites applications for 2011–2012. This highly competitive institutional award is open to recent doctorates (degree within the past 3 years) in geosciences. We welcome applicants with research interests across the full range of geosciences disciplines. The postdoctoral fellow is expected to pursue their own independent research interests. The appointment is for two years with a salary of \$60,000 per year plus health and dental benefits. Research support of \$10,000 per year is also provided. Successful applicants can begin their program as early as 1 Sept. 2011 but no later than 31 Dec. 2011.

To apply, submit a current CV that includes education, employment history, awards, publications, and extramural funding record, a short (2–3 page) statement of research interests and proposed research, and the names and contact information for three references. Deadline for applications is 15 March 2011. Applicants should send applications electronically as email attachment to [PostDoc.JSG@jsg.utexas.edu](mailto:PostDoc.JSG@jsg.utexas.edu).

The University of Texas at Austin is an Affirmative Action/Equal Opportunity Employer.

## Opportunities for Students

**2011 Graduate Student Grant Program, The Spackman Award:** The Society for Organic Petrology (TSOP) invites applications for graduate student research grants, the Spackman Award. The purpose of the grants is to foster research in organic petrology (which includes coal petrology, kerogen petrology, organic geochemistry and related disciplines) by providing support to graduate students from around the world. Monetary awards up to a maximum of US\$1,000 will be granted. The program awards a maximum of two grants each year. Grants are to be applied to expenses directly related to the student's thesis program, such as field-work, laboratory analyses, etc. A portion (not to exceed 25%) of the funds may be used to attend TSOP Annual Meetings. A committee of at least three TSOP members (and/or external experts when needed) will review the pool of applications. The reviewers will be drawn from people having no association with the host institution of any applicant. Each reviewer will independently rank each proposal according to established merit criteria, using the Application Evaluation Form included in the application packet. The cumulative score from all of the reviewers will be used to determine the final ranking of the applications. Winners will be notified prior to the 2011 Annual Meeting, and all applicants will be informed by e-mail of the final status of their applications. TSOP Spackman Award application deadline is 16 May 2011. Grants will be awarded in September 2011. Detailed information and an application form are on the TSOP website: [www.tsop.org/grants.htm](http://www.tsop.org/grants.htm) or applications may be obtained from: Prof Colin Ward, Chair, TSOP Research Committee, School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, NSW, 2052, Australia; e-mail: [c.ward@unsw.edu.au](mailto:c.ward@unsw.edu.au).

**The History and Philosophy of Geology (HAPG) Division of GSA** sponsors a US\$500 award for the best paper in history and philosophy of geology to be submitted for presentation by the student at the annual GSA meeting. The proposed paper may be (1) A paper in the history and philosophy of geology; or (2) a literature review of ideas for a technical work or thesis/dissertation; or (3) some imaginative aspect of the history and philosophy of geology we have not thought of before. The paper may be in either oral or poster form, and is to be presented at the HAPG disciplinary session at the annual GSA meeting. Please send complete applications to Dr. Jane Davidson ([jdhexen@unr.edu](mailto:jdhexen@unr.edu)), Secretary of the HAPG Division, by 1 May 2011. Information about the application process is available at [gsahist.org/HoGaward/student-award.htm](http://gsahist.org/HoGaward/student-award.htm).



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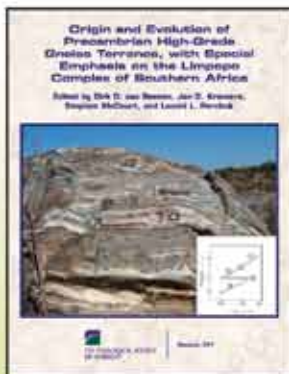
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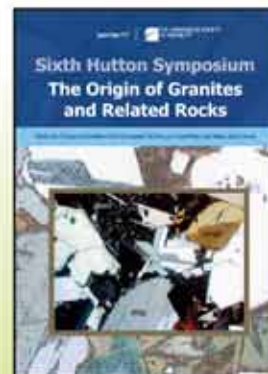




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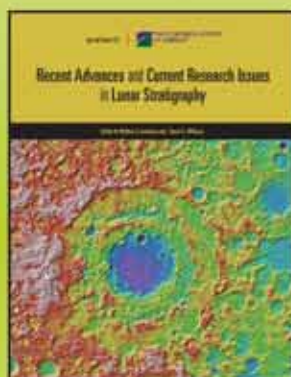
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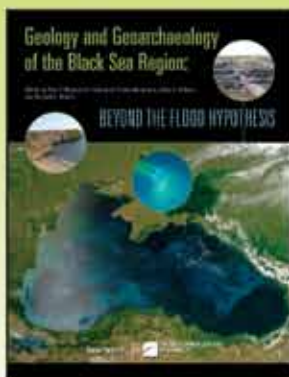
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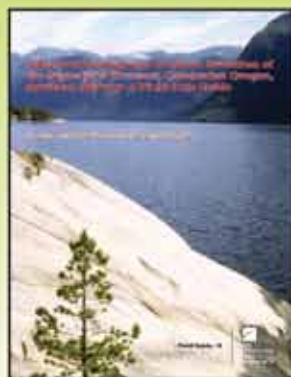
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