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CELEBRATE GSA'S 125TH ANNIVERSARY

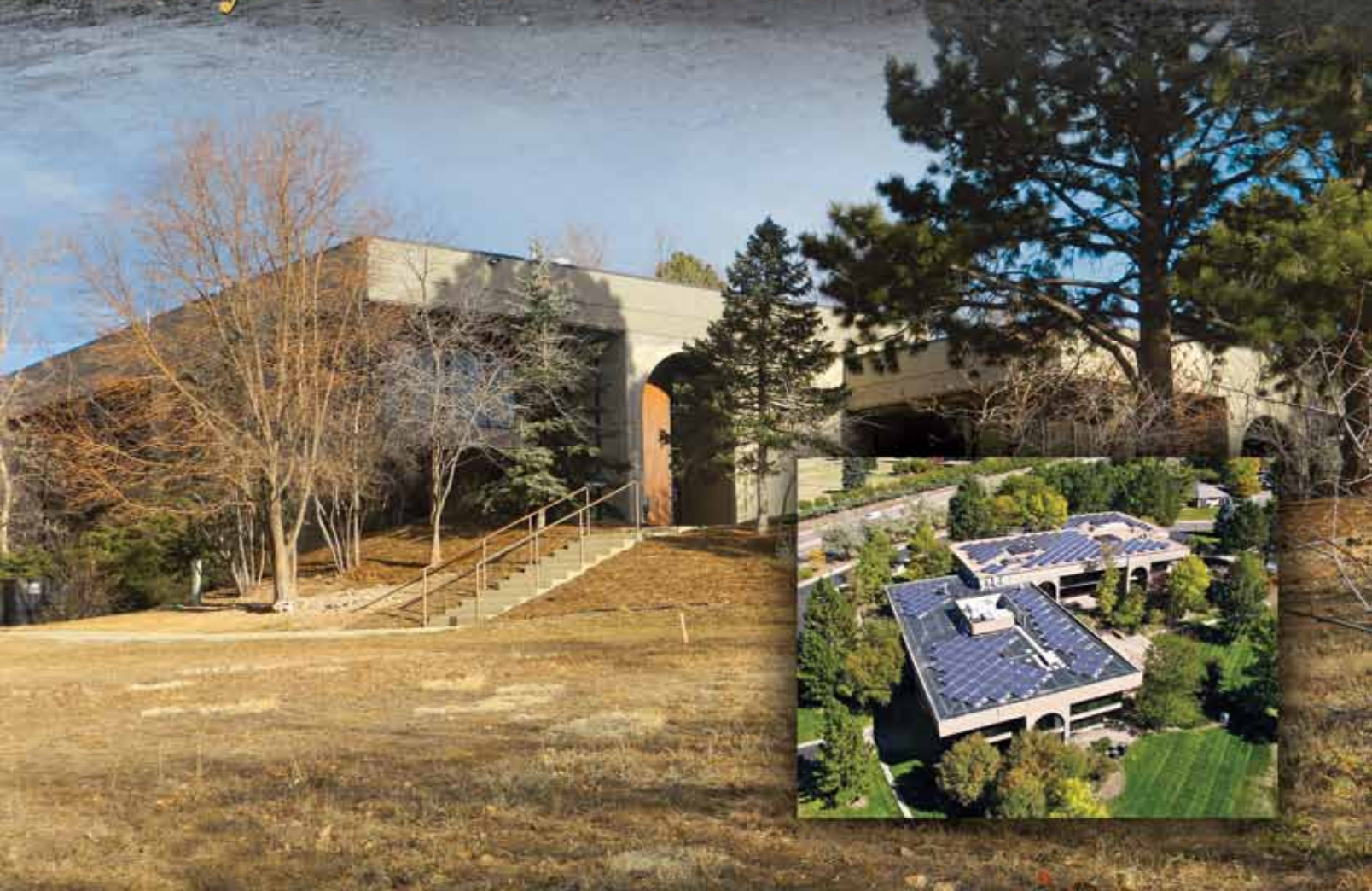
GSA TODAY



A PUBLICATION OF THE GEOLOGICAL SOCIETY OF AMERICA®

GSA Headquarters: April 1973 (top) and Today: GSA Holds to a Solid Foundation

APRIL/MAY 2013 | VOL. 23, NO. 4/5





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- ◆ Growing production and proved reserves
- ◆ Solid balance sheet and low debt



GSA TODAY (ISSN 1052-5173 USPS 0456-530) prints news and information for more than 25,000 GSA member readers and subscribing libraries, with 11 monthly issues (April/May is a combined issue). *GSA TODAY* is published by The Geological Society of America® Inc. (GSA) with offices at 3300 Penrose Place, Boulder, Colorado, USA, and a mailing address of P.O. Box 9140, Boulder, CO 80301-9140, USA. GSA provides this and other forums for the presentation of diverse opinions and positions by scientists worldwide, regardless of race, citizenship, gender, sexual orientation, religion, or political viewpoint. Opinions presented in this publication do not reflect official positions of the Society.

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GSA TODAY STAFF

Executive Director and Publisher: John W. Hess

Science Editors: Bernie Housen, Western Washington Univ. Geology Dept. (ES 425) and Advanced Materials Science and Engineering Center (AMSEC), 516 High Street, Bellingham, WA 98225-9080, USA, bernieh@wwwu.edu; R. Damian Nance, Ohio University Dept. of Geological Sciences, 316 Clippinger Laboratories, Athens, OH 45701, USA, nance@ohio.edu

Managing Editor: K.E.A. "Kee" Giles, kgiles@geosociety.org, gsatoday@geosociety.org

Graphics Production: Margo McGrew

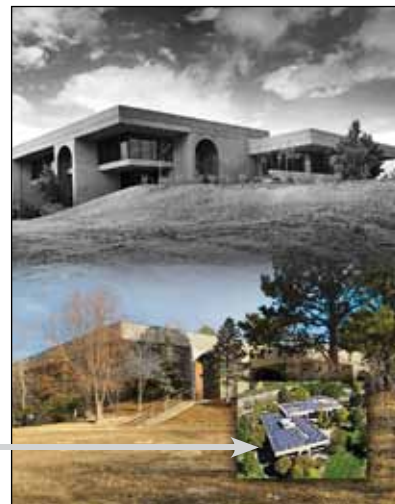
Advertising (classifieds & display): Ann Crawford, +1-800-472-1988 ext. 1053; +1-303-357-1053; Fax: +1-303-357-1070; advertising@geosociety.org; acrawford@geosociety.org

GSA Online: www.geosociety.org

GSA TODAY: www.geosociety.org/gsatoday/

Printed in the USA using pure soy inks.

Cover: The Geological Society of America building at 3300 Penrose Place, Boulder, Colorado, USA: 1973 and today (bottom photo by Eric Christensen). The building was designed by Everett & Zeigel Architects and completed in 1972. It received the Award of Excellence from the Rocky Mountain Chapter of the American Concrete Institute that year. Inset (courtesy of Tim Ray, Vantage Point Imagery): GSA's 66-kilowatt solar-panel system was installed on the roof in October 2010.

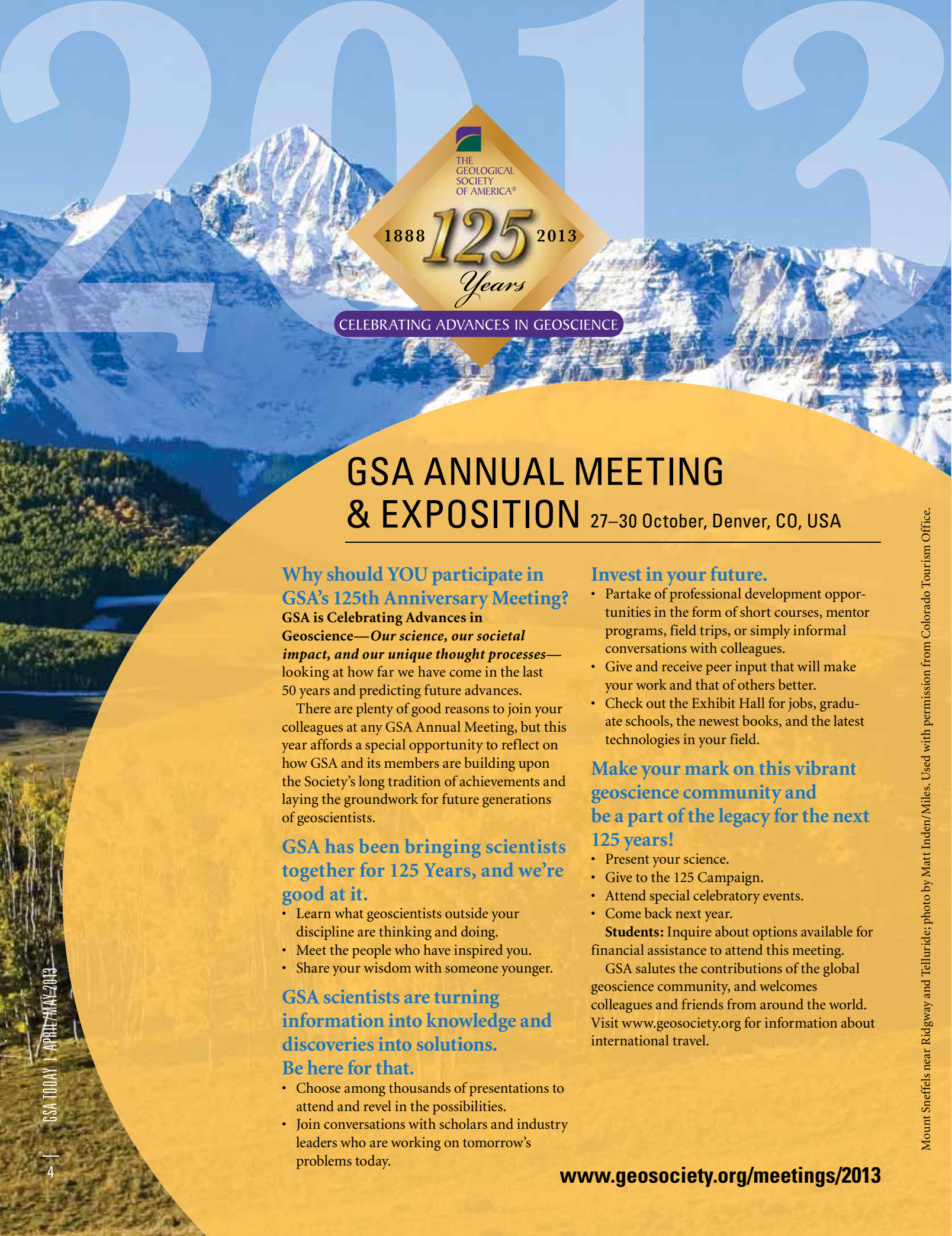


- 4 2013 GSA Annual Meeting & Exposition
- 5 Call for Papers
- 6 Topical Sessions
- 38 Discipline Categories



- 40 **Geologic Past:** 1963 GSA Annual Meeting Science Highlights, Part 1
- 42 **GSA Today Science Benefits from GSA's 125-Year Legacy**
- 44 **Call for Proposals:** GSA Division Awards
- 46 **GSA International Distinguished Lecture Tour Update**
- 47 **In Memoriam**
- 47 **About People**
- 48 **Call for GSA Committee Service:** Help Celebrate GSA's Role in Advancing the Geosciences through Your Gifts of Time and Talent
- 52 **GSA Foundation Update**
- 53 **GSA Foundation's Silent Auction**
- 54 **GeoCorps™ America 2012 Highlights**
- 55 **GSA GeoVentures**
- 55 **2nd International EarthCache™ Mega Event**
- 56 **Classified Advertising**
- 60 **Groundwork:** How Good Do Natural Hazard Assessments Need to Be?





THE
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125

2013

Years

CELEBRATING ADVANCES IN GEOSCIENCE

GSA ANNUAL MEETING & EXPOSITION 27–30 October, Denver, CO, USA

Why should YOU participate in GSA's 125th Anniversary Meeting?

GSA is Celebrating Advances in Geoscience—*Our science, our societal impact, and our unique thought processes*—looking at how far we have come in the last 50 years and predicting future advances.

There are plenty of good reasons to join your colleagues at any GSA Annual Meeting, but this year affords a special opportunity to reflect on how GSA and its members are building upon the Society's long tradition of achievements and laying the groundwork for future generations of geoscientists.

GSA has been bringing scientists together for 125 Years, and we're good at it.

- Learn what geoscientists outside your discipline are thinking and doing.
- Meet the people who have inspired you.
- Share your wisdom with someone younger.

GSA scientists are turning information into knowledge and discoveries into solutions.

Be here for that.

- Choose among thousands of presentations to attend and revel in the possibilities.
- Join conversations with scholars and industry leaders who are working on tomorrow's problems today.

Invest in your future.

- Partake of professional development opportunities in the form of short courses, mentor programs, field trips, or simply informal conversations with colleagues.
- Give and receive peer input that will make your work and that of others better.
- Check out the Exhibit Hall for jobs, graduate schools, the newest books, and the latest technologies in your field.

Make your mark on this vibrant geoscience community and be a part of the legacy for the next 125 years!

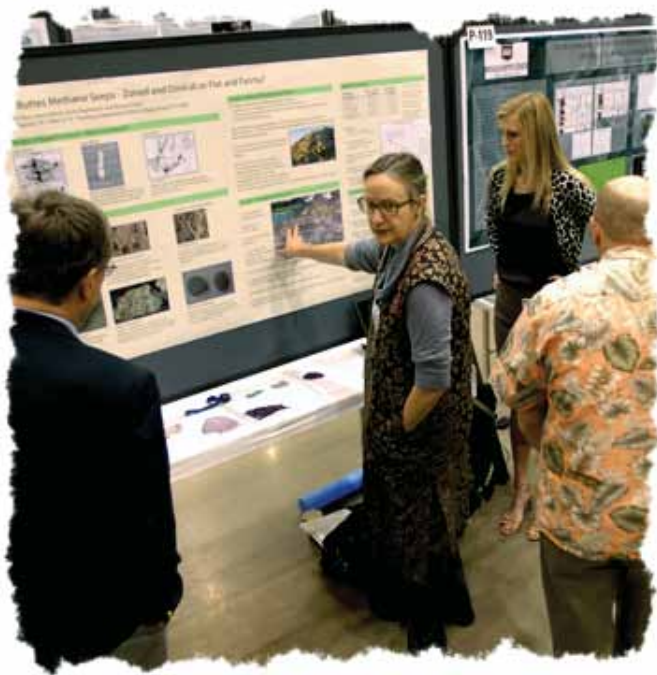
- Present your science.
- Give to the 125 Campaign.
- Attend special celebratory events.
- Come back next year.

Students: Inquire about options available for financial assistance to attend this meeting.

GSA salutes the contributions of the global geoscience community, and welcomes colleagues and friends from around the world. Visit www.geosociety.org for information about international travel.

CALL FOR PAPERS

Abstracts deadline: Tues., 6 August



THREE WAYS TO PRESENT

1. **Oral** (12 min. plus 3 min. of Q&A). You *must* visit the Speaker Ready Room at least 24 hours before your scheduled presentation. Provided: All technical session rooms are equipped with a PC using MS Office 2013.
2. **Posters**: Provided: one horizontal 8-ft. by 4-ft. display board; hook & loop tape for hanging your poster; a shared 6-ft. by 30-in. table; and electricity (please bring your own extension cord).
3. **Digital Posters**: Provided: one horizontal 8-ft. by 4-ft. display board; hook & loop tape for hanging a poster; a monitor (~40 to 46 inch) on a 6-ft. by 30-in. table; internet; electricity; and a VGA cable along with sound. (Bring your own laptop and white dongle if using a Mac.)

NEW hours for poster (including digital) presentations:

Sun., 9 a.m.–5 p.m., with authors present 3–5 p.m.;
 Mon.–Wed., 9 a.m.–6:30 p.m., with authors present during the afternoon beer reception, 5–6:30 p.m. Presenters are also encouraged to be present for one hour in the morning and one hour in the afternoon.

2013 Technical Program Co-Chairs

Dick Berg, rberg@illinois.edu

Kevin Mickus, kevinmickus@missouristate.edu

SUBMITTING AN ABSTRACT

- To begin submission, go to <http://gsa.confex.com/gsa/2013AM/index.epl>.
- A submission fee of US\$45/professionals, US\$25/students, US\$80/digital posters will be charged.
- You may present two volunteered abstracts during the Annual Meeting, *as long as one of these abstracts is a poster (including digital poster) presentation.*



www.geosociety.org/meetings/2013/

Action dates

Abstract submissions form: Open NOW

Registration opens: Early June

Housing opens: Early June

Space request deadline: Wed., 5 June
(fees go up after this date)

Abstracts deadline: Tues., 6 Aug.

Early registration deadline: Mon., 23 Sept.

Housing deadline: Mon., 30 Sept.

Registration cancellation deadline: Mon., 30 Sept.

CONTENTS

T13–T15: Archaeological Geology p. 8

T101: Coal Geology p. 18

T97–T100: Economic Geology p. 18

T70–T75: Engineering Geology p. 15

T76–T89: Environmental Geoscience p. 15

T150–T169: Geochemistry p. 24

T90–T92: Geoinformatics p. 17

T93–T96: Geology and Health p. 17

T170–T174: Geology and Public Policy p. 26

T102–T112: Geophysics/Tectonophysics/Seismology p. 19

T113–T138: Geoscience Education p. 20

T139–T144: Geoscience Information/Communication... p. 23

T145–T149: History and Philosophy of Geology p. 24

T34–T57: Hydrogeology p. 11

T58–T63: Karst p. 13

T64–T68: Limnogeology p. 14

T69: Marine/Coastal Science p. 14

T214–T217: Mineralogy/Crystallography p. 32

T225–T231: Paleoclimatology/Paleoceanography p. 33

T232–T249: Paleontology p. 33

T250–T255: Petroleum/Energy p. 36

T218–T223: Petrology, Igneous/Metamorphic/Experimental p. 32

T1, T3–T12: Planetary Geology p. 7

T256–T258: Precambrian Geology p. 37

T2, T16–T33: Quaternary Geology and Geomorphology p. 8

T175: Remote Sensing/Geographic Info System p. 27

T193–T197: Sediments, Carbonates/Clastic p. 29

T198–T200: Stratigraphy p. 29

T201–T213: Structural Geology p. 30

T178–T192: Tectonics p. 27

T176–T177: Volcanology p. 27



TOPICAL SESSIONS

DETAILS & DESCRIPTIONS

These sessions are topically focused, with a mix of invited and volunteered papers. They are sorted by **primary discipline**, but *most sessions are designed to be interdisciplinary*. Related disciplines are listed with each session; further details are online at www.geosociety.org/meetings/2013/.



Photo used with permission from NASA.

PLANETARY GEOLOGY

T1. Curiosity at Gale—Past and Present Environments of Mars

Disciplines: Planetary Geology; Sediments, Clastic; Geomorphology

Advocates: Kenneth S. Edgett; Juergen S. Schieber; Linda C. Kah

Mars exploration is revealing a wealth of information regarding the early evolution of the terrestrial planets. We encourage contributions focused on geology in Gale Crater via data collected by the *Curiosity* Rover and orbiting spacecraft.

T3. Discovering Other Worlds: The Growth of Planetary Science in Geoscience Education

Disciplines: Planetary Geology; Geoscience Education

Advocates: Erin Kraal; Nicholas P. Lang

More than 200 missions have explored our solar system and beyond in the past 50 years. This session examines the impact of past, present, and future planetary science programs through teaching, outreach, and student research programs.

T4. Geologic Mapping of Planetary Bodies across the Solar System

Disciplines: Planetary Geology; Geomorphology; Stratigraphy

Advocates: Debra L. Buczkowski; Danielle Y. Wyrick

We encourage abstracts related to the description of the geologic mapping (and subsequent analysis) of solid solar system bodies, including the terrestrial planets, moons, and asteroids.

T5. Impact Cratering in the Solar System: Fire to Ice—Vacuum to Atmospheres

Disciplines: Planetary Geology; Geophysics/Tectonophysics/Seismology; Geochemistry

Advocates: Jeffrey B. Plescia; Christian Koeberl; Mark B. Boslough

This session focuses on the nature of impacts, with terrestrial craters providing ground-truth for the interpretation of planetary craters. Contributions regarding morphology, shock processes, materials, modeling, impactor evolution, airburst phenomena, and comparisons of cratering among planets are encouraged.

T6. Landscape Evolution on the Terrestrial Planets: The G.K. Gilbert Award Session

Disciplines: Planetary Geology; Geomorphology

Advocate: Robert C. Anderson

We encourage abstracts on the description and evolution of planetary landscapes related to fluvial geomorphic processes, meteorite bombardment, and sublimation, including modeling and terrestrial analogs. Talks will be given by the awardee, colleagues, and former students.

T7. Lunar Water from Surface to the Interior: Origin and Distribution

Disciplines: Planetary Geology; Geochemistry; Remote Sensing/Geographic Info System

Advocates: Y. Liu; Francis McCubbin; Lawrence A. Taylor

This session seeks to bring together diverse aspects of lunar water research and promote discussion of recent results of lunar water studies from surface to the interior.

T8. Meteorites of Northwest Africa: New Discoveries, Cutting-Edge Science, and Advances in Planetary Geology

Disciplines: Planetary Geology; Geochemistry; Petrology, Igneous

Advocate: Matthew L. Morgan

The hot deserts of northwest Africa have yielded an array of exotic meteorite types that are redefining the composition of and geologic process on planetary bodies. This session will examine the chemistry and mineralogy of these rare meteorites.

T9. Outer Satellite Exploration: The Next 50 Years

Disciplines: Planetary Geology; Geophysics/Tectonophysics/Seismology

Advocates: Louise M. Prockter; Jani Radebaugh

This session will discuss results of geological studies of the outer planet satellites from telescopic observations and planetary missions and discuss plans for upcoming missions to more thoroughly explore these geologically active worlds.

T10. The Surprising Innermost Planet

Discipline: Planetary Geology

Advocates: Carolyn M. Ernst; Brett W. Denevi

Orbital observations by the *MESSENGER* spacecraft have shown that Mercury is unusual among the terrestrial planets in many respects. This session will showcase findings from recent geological, geochemical, and geophysical investigations of Mercury's surface and interior.

T11. Topics in Planetary Geology (Posters)

Discipline: Planetary Geology

Advocates: Simon A. Kattenhorn; Robert C. Anderson

The wide diversity of solar system bodies encompasses a broad range of geological processes and histories. We encourage submissions of poster abstracts on topics of current interest in planetary geology.

T12. Voyager to New Horizons: Exploring Surface and Interior Processes of Icy Worlds

Disciplines: Planetary Geology; Structural Geology; Tectonics

Advocates: Emily S. Martin; D. Alex Patthoff; Simon A. Kattenhorn

We encourage abstracts relating to surface processes, structural and tectonic processes, interiors, and thermal evolution of icy satellites, KBOs, and planetary analogs. This includes experimental, observational, and theoretical modeling approaches.



ARCHAEOLOGICAL GEOLOGY

T13. Celebrating Advances in Archaeological Geology: Past, Present, and Future

Disciplines: Archaeological Geology; Quaternary Geology; Geomorphology

Advocates: Laura R. Murphy; Christopher L. Hill; Justin A. Holcomb

This session focuses on the history of interactions between geoscience and archaeology. We welcome papers that address the history of archaeological geology as well as the present and future of applied geoscience methodologies to archaeology.

T14. Geologic Hazards in Archaeological Contexts

Disciplines: Archaeological Geology; Quaternary Geology; Stratigraphy

Advocates: Breanyn MacInnes; Vera Ponomareva; Erik Gjesfeld

Geologic hazards provide valuable time markers in archaeological excavations, but these events had potentially devastating impacts on ancient populations. This session seeks papers that explore the chronological and anthropological impacts of ancient geologic hazards.

T15. The Human Response to Climatic Changes, Natural Disasters, and Environmental Over-Exploitation in the Andes: Examining Ancient Adaptive Strategies through the Geoarchaeological Record

Disciplines: Archaeological Geology; Remote Sensing/ Geographic Info System; Geomorphology

Advocate: Michele Koons

This session will examine the human response to climatic changes, such as the effects of the ENSO cycle; natural disasters, including earthquakes and tsunamis; and environmental over-exploitation, such as deforestation in the Andean region.

QUATERNARY GEOLOGY AND GEOMORPHOLOGY

T2. From the Sahara to MARS and Beyond: The History and Future of Aeolian Research (Posters)

Disciplines: Quaternary Geology; Sediments, Clastic; Planetary Geology

Advocates: Nicholas Lancaster; Alan F. Halfen

Ralph A. Bagnold explored the deserts of Libya more than 75 years ago and effectively created the field of modern aeolian science, which today extends millions of miles beyond the dunes of the Sahara to Mars. This session will explore the history of aeolian research, current advances, and future research avenues through a mixture of presentations by internationally renowned career scientists, early-career scientists, and students.

T16. Carbon and Landscape Dynamics

Disciplines: Geomorphology; Quaternary Geology; Environmental Geoscience

Advocates: Ellen Wohl; Mary Ann Madej

Geoscientists provide unique insight regarding sources of fossil carbon, terrestrial and aquatic transfer of carbon, and carbon sequestration over diverse time periods. This session reviews geoscience contributions to understanding carbon dynamics and highlights outstanding questions.

T17. Coupling Interactions between Fluvial and Aeolian Processes in Drylands: Assessment and Quantification of Their Role in Geomorphological Change and in an Era of Climatic Uncertainty

Disciplines: Geomorphology; Quaternary Geology; Sediments, Clastic

Advocates: Margaret Hiza Redsteer; Amy E. Draut; Rian Bogle

Processes of landscape mobility and land degradation by erosion are affected by the coupling of transport by wind and water. This session draws attention to their relevance in studies of climate change and land use.

T18. Critical Zone Evolution: Climate and Exhumation

Disciplines: Geomorphology; Geochemistry; Hydrogeology

Advocates: Suzanne P. Anderson; David P. Dethier; Gregory E. Tucker; Robert S. Anderson

The architecture of the critical zone (CZ)—its thickness, character, and three-dimensional shape—is governed by erosion and weathering. We encourage submissions that explore processes, rates, and feedbacks among climate, rock type, and exhumation that drive CZ evolution.

T19. G.K. Gilbert and Geomorphology at GSA's 125th

Disciplines: Geomorphology; Quaternary Geology; Limnogeology

Advocates: Kathleen Nicoll; Paul Jewell

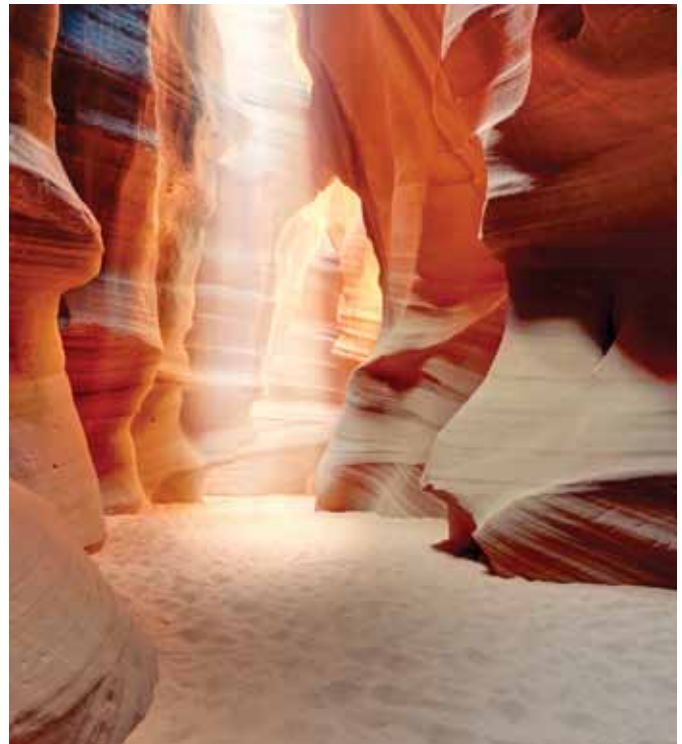
We welcome abstracts on themes related to the history of evolving paradigms in geomorphic inquiry and Grove Karl Gilbert's observations regarding landscapes, tectonics, and climate change in the American west (and beyond).

T20. Pre-Wisconsin (Early–Middle Pleistocene) Glaciations and Interglaciations in North America

Disciplines: Geomorphology; Paleoclimatology/Paleoceanography; Quaternary Geology

Advocates: David A. Grimley; Olivier Caron

Topics may include glacial history, pedogenesis, sedimentology, geomorphology, glacial or proglacial processes, provenance, paleoclimate, ecology, chronology, or regional to global correlations. Abstracts that highlight recent findings or discuss application of new methodologies are encouraged.



T21. Peaks to Plains: Late Cenozoic Landscape Evolution of the Rocky Mountains and Western Great Plains

Disciplines: Geomorphology; Tectonics; Paleoclimatology/Paleoceanography

Advocates: Margaret E. McMillan; Eric M. Leonard

This session explores the effects of driving versus resisting forces on erosion, uplift, and exhumation of the U.S. Rocky Mountains and adjacent Great Plains. We encourage all field, laboratory, and modeling studies of form and process in this distinctive region.

T22. Quantifying Mountain Evolution from the Lithosphere to the Landscape

Disciplines: Geomorphology; Tectonics; Structural Geology

Advocates: Alison Duvall; Brian J. Yanites; Delores M. Robinson

This session will unite geoscientists who integrate modeling and observations of processes at different space and time scales to understand how mountain systems evolve. Processes can be tectonic or geomorphic.

T23. Applications of Near-Surface Geophysics, Remote Sensing, Geomorphology, and Hydrology to the Investigation of Rock Glaciers and Other Periglacial Features in Alpine Environments

Disciplines: Quaternary Geology; Geophysics/Tectonophysics/Seismology; Remote Sensing/Geographic Info System

Advocates: Claudio Berti; Gregory S. Baker; Michael O'Neal; Edward B. Evenson; Patrick A. Burkhart; Andres Meglioli

Human impact is increasing in alpine permafrost and periglacial environments. Valuable resources reside in mountainous regions, creating an urgent need for a quantitative understanding of these environments. Papers on geophysics, remote sensing, and other quantitative methods are encouraged.

T24. Climate Change in the Interior Western United States from the Last Glacial Maximum to the Holocene**Disciplines:** Quaternary Geology; Paleoclimatology/
Paleoceanography; Geomorphology**Advocates:** Eric M. Leonard; Benjamin J.C. Laabs

This session examines changing climate in the Interior Western U.S. from the Last Glacial Maximum through the establishment of the modern climate regime in the Holocene. Modeling and proxy-data studies of patterns, magnitudes, and rates of climate change are encouraged.

T25. Deserts: Quaternary Hydro-Geomorphologic, Climatic, and Environmental Changes in the World's Deserts—Honoring Prof. Farouk El-Baz**Disciplines:** Quaternary Geology; Geomorphology**Advocates:** Yehouda Enzel; Stephen G. Wells

We seek abstracts that address changes and processes in the world's deserts at all temporal and spatial scales using data gathered through methodologies derived from Quaternary geology, geomorphology, hydrology, and ecology.

T26. 3-D Visualization in the Geological Science (Digital Posters)**Disciplines:** Geomorphology; Geoscience Education; Structural Geology**Advocate:** Alan F. Halfen

This digital poster session will highlight the application of 3-D visualization in geological science, including mapping, basin analysis, geoscience education, and others. Presenters will have the option to display some material using a 3-D display.

T27. Geomorphic Response to Quaternary Climate Change: A Session in Memory of James C. Knox**Disciplines:** Quaternary Geology; Geomorphology;
Paleoclimatology/Paleoceanography**Advocates:** William C. Johnson; Joseph A. Mason

This session will pay tribute to the legacy of James C. Knox. During his 43-year career, Jim made major contributions to fluvial geomorphology and sedimentology, flood hydrology, paleopedology, and forcing by climate and land-use change.

T28. Is Bioturbation a Major Process in the Evolution of Soils and Landscapes?**Disciplines:** Quaternary Geology; Archaeological Geology;
Environmental Geoscience**Advocate:** Donald L. Johnson

This session will focus on the role of bioturbation in the evolution of landforms and soils. Presenters will be challenged to answer, or attempt to answer, the question posed by the session title.

T29. New Frontiers in Cosmogenic Nuclide Applications: Pushing Analytical and Geological Limits to Understand the Past, Present, and Future of Earth's Surface**Disciplines:** Quaternary Geology; Geomorphology; Tectonics**Advocates:** Susan H. Zimmerman; Alan J. Hidy

Unprecedented examination of earth-surface processes is now feasible, through innovative cosmogenic nuclide techniques and improving AMS precision, along with new spatial imaging techniques. Abstracts including landscape evolution, glacial history, neotectonics, and sediment transport are encouraged.

T30. Past Records and Future Challenges of Glacier and Ice Sheet Response to Climate Change; Honoring and Building on the Legacy of Mark Meier**Disciplines:** Quaternary Geology; Paleoclimatology/
Paleoceanography; Environmental Geoscience**Advocates:** Scott Lundstrom; Andrew G. Fountain;
Carolyn L. Driedger; W. Tad Pfeffer

Glaciers are globally important to water resources, sea level, ecosystems, and much more. This session welcomes glaciologic and glacial geologic reports on past, current, and future glacial response to climate change on various time scales.

T31. Recent Advances in Understanding Great Basin Paleoclimate**Disciplines:** Quaternary Geology; Paleoclimatology/
Paleoceanography; Limnogeology**Advocates:** Guleed A.H. Ali; Kenneth D. Adams

This session encourages presentation of new observations and geochronology leading toward new interpretations of Pleistocene and Holocene lake level changes and other climate-related effects in the western U.S. Great Basin.

T32. The Co-Evolution of Soils and Landscapes in the Quaternary**Disciplines:** Quaternary Geology; Geomorphology;
Hydrogeology**Advocates:** Todd G. Caldwell; Martha Cary Eppes

Soils result from a coupling between biotic and abiotic factors and are inextricably linked to the landscapes in which they form. This session welcomes research linking pedogenesis and/or weathering to surficial processes, and vice-versa.

T33. The Snowmastodon Project: A Multi-Proxy Approach to Understanding the Response of Alpine Ecosystems to Climate Change in the Colorado Rockies**Disciplines:** Quaternary Geology; Paleontology, Paleocology/
Taphonomy; Paleoclimatology/Paleoceanography**Advocates:** Jeffrey S. Pigati; Ian Miller; Kirk Johnson;
R. Scott Anderson

Paleoclimatic proxy records from a world-class paleontologic site near Snowmass Village, Colorado, USA, provide insight into how alpine ecosystems responded to climate change in the Rocky Mountains during the last interglacial period.

HYDROGEOLOGY

T34. Advances in Unsaturated Zone Geophysics

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

Advocates: John W. Lane; Kamini Singha

This session focuses on geophysical methods for quantitative estimation and imaging of unsaturated zone hydrologic properties and processes. Laboratory- to field-scale examples of new methods to acquire, analyze, and interpret vadose zone geophysics are encouraged.

T35. Bottoms Up! Shallow Water Table Influences on Vadose Zone Biogeochemistry and Ecohydrology

Disciplines: Hydrogeology; Environmental Geoscience; Geochemistry

Advocates: Wesley R. Henson; David Kaplan

Topics will focus on the influence of shallow water table conditions on hydrologic and biologic processes that control the unsaturated zone's biogeochemistry, contaminant fate and transport, and ecological community structure and composition.

T36. Impacts of Land-Use Change and Disturbances on Unsaturated-Zone Ecohydrology

Discipline: Hydrogeology

Advocates: Kim S. Perkins; David Bedford; Darren Sandquist

Land-use change profoundly impacts unsaturated-zone biotic and hydrologic processes, such as subsurface moisture dynamics, infiltration and runoff, sedimentary erosion and deposition, biodiversity, and ecological function. This session will explore recent work in assessing these process changes and related effects.

T37. Recent Advances in the Theory, Characterization, and Modeling of Unsaturated Zone Processes

Disciplines: Hydrogeology; Environmental Geoscience; Geochemistry

Advocates: C. Amanda Garcia; Michael H. Young; David A. Stonestrom

This session focuses on advances in understanding unsaturated zone processes that control gas and water transport using field and laboratory measurements and theoretical and numerical models. Topics considering the groundwater-atmosphere continuum are of particular interest.

T38. Vadose Zone Flow and Transport in Natural or Engineered Systems under Extreme Conditions

Disciplines: Hydrogeology; Environmental Geoscience

Advocates: Zhuanfang F. Zhang; Hui-Hai Liu; Jianting Zhu

This session seeks theoretical or experimental studies, measurement techniques, simulations, and technologies involving flow and solute transport at low water content, in very coarse materials, low-permeability media, fractured systems, soil-gravel mixtures, and across the soil texture interfaces.



Horseshoe Bend of the Colorado River, Arizona, USA.

T39. Anomalies, Surprises, Irregularities, and Contradictions in Variably-Saturated Subsurface Flow

Disciplines: Hydrogeology; Environmental Geoscience; Geomorphology

Advocates: Benjamin B. Mirus; Brian Ebel; John Nimmo

This session focuses on observation and analysis of unexpected subsurface flow phenomena and novel hydrological models with an overarching goal of generating improved conceptual understanding of unexplained variably saturated flow and transport processes.

T40. Applications and Developments of Coupled Hydrologic Models

Disciplines: Hydrogeology; Environmental Geoscience; Engineering Geology

Advocates: Christopher S. Lowry; Richard G. Niswonger; Reed M. Maxwell

The focus of this session will be the use and development of coupled/linked hydrologic models in research and resource management.

T41. Contaminant Migration through the Groundwater–Surface-Water Interface: Processes, Impacts, and Implications for Remediation

Disciplines: Hydrogeology; Geochemistry; Environmental Geoscience

Advocates: David R. Lee; Brewster Conant; Philippe Van Cappellen

What effect does the interface have on the fate and ecological impacts of groundwater contaminants passing through it? We seek papers concerning biogeochemical and transport processes within the interface and implications for attenuation and remediation.

T42. Current Groundwater Challenges in the Rocky Mountain Region

Disciplines: Hydrogeology; Environmental Geoscience; Engineering Geology
Advocates: Bob Reynolds; Matt Welsh; Kurt Hinaman; Ralf Topper; Kevin Boyce

This session will capture the recent status of regional critical groundwater supply issues in alluvial and bedrock aquifers. Our goal is to present a socially relevant update on the impact of this precious water resource in our Great American Desert.

T43. Ecohydrological Impacts from Climate-Induced Changes in Land Cover and Vegetation in Mountain Environments

Discipline: Hydrogeology
Advocates: John E. McCray; Kristin M. Mikkelsen; Nicholas B. Engdahl

Climate change can increase ecosystem susceptibility to pests and other stressors, which can lead to large-scale disturbances that subsequently alter hydrology and biogeochemistry. This session discusses the impacts climate-induced phenomena, such as insect infestations, have on biogeochemistry, water-quality, and quantity.

T44. Environmental Arsenic: The Nexus of Natural Occurrences and Human Health

Disciplines: Hydrogeology; Geology and Health; Environmental Geoscience
Advocates: Prosun Bhattacharya; Abhijit Mukherjee; Saugata Datta; Karen Johannesson; Mohammad Alauddin

Geogenic arsenic contaminates drinking water resources, soils, and crops, and a comprehensive approach for risk assessment is necessary for sustainable mitigation.

T45. Envisioning a Digital Crust: A 3-D Data System of Crustal Material Properties in Support of Large-Scale Fluid-Flow Simulations in Earth System Modeling

Disciplines: Hydrogeology; Geoinformatics; Environmental Geoscience
Advocate: Jennifer S. Arrigo

The session brings together geoscientists and geoinformatics experts to discuss the challenges, opportunities, and progress in large-scale 3-D geologic modeling and data infrastructure that enable flexible support for regional to continental-scale fluid flow modeling.

T46. Experimental Study and Numerical Simulation of Reactive Chemical Transport in Complex Subsurface Media

Disciplines: Hydrogeology; Environmental Geoscience; Geochemistry
Advocates: Hongbin Zhan; David A. Benson

This session is focused on new ideas and methods for experiments, observation, and modeling of reactive chemical transport in heterogeneous media.

T47. Founders or Leaders in Hydrogeology

Disciplines: Hydrogeology; History and Philosophy of Geology
Advocate: John Moore

Abstracts are sought regarding hydrogeologists who have made exceptional contributions to the science of hydrogeology in the United States.

T48. Ground-Source Geothermal Energy Systems: A Significant Emerging Resource

Disciplines: Hydrogeology; Environmental Geoscience; Petroleum/Energy

Advocates: Carolyn B. Dowling; Lee J. Florea; Klaus Neumann

This session welcomes all aspects of research on geothermal energy, such as geophysical and engineering methods and water resource issues.

T49. Groundwater Extremes: Groundwater's Role in Drought, Floods, Depletion, Subsidence, Landslides, and Sea-Level Rise

Disciplines: Hydrogeology; Environmental Geoscience; Engineering Geology

Advocates: William L. Cunningham; Rodney A. Sheets; Thomas J. Burbey

Groundwater is integral to many extreme hydrologic events and geologic hazards, yet its role is often underappreciated and sometimes ignored. This session provides a forum for groundwater-based research related to these events and hazards.

T50. Evolution of Hydrogeology 1976–2010

Disciplines: Hydrogeology; History and Philosophy of Geology
Advocate: John Moore

This session covers the influence of professional societies, groundwater contamination, hydrogeologic education, and numerical method.

T51. Hydrogeology, Pore Pressure, and Induced Seismicity

Disciplines: Hydrogeology; Geophysics/Tectonophysics/Seismology; Engineering Geology

Advocates: Barbara A. Bekins; Shemin Ge; Jonathan W. Godt

This session will examine why a few injection wells cause earthquakes when the vast majority do not. Modeling and case studies of wastewater injection, enhanced oil recovery, and geothermal reservoirs are welcome.

T52. Innovative Teaching of Hydrogeology

Disciplines: Hydrogeology; Geoscience Education
Advocates: Peter E. Riemersma; Susan Swanson; Maureen A. Muldoon

We encourage abstracts that showcase effective methods of teaching hydrogeology in the classroom, laboratory, and field. We especially solicit presentations that highlight advances in the discipline and those that successfully address fundamental concepts of hydrogeology.

T53. Mountain Groundwater: Recent Advancements in the New Era of Climate Change and Resource Development

Disciplines: Hydrogeology; Engineering Geology; Environmental Geoscience

Advocates: Andrew H. Manning; Jonathan Saul Caine; Lyndsay B. Ball

Mountain hydrologic systems are rapidly evolving in the face of climate warming and competing resource needs. We welcome abstracts from multiple disciplines that provide new perspectives and understanding of mountain groundwater under these mounting pressures.

T54. Remote Sensing of the Cryosphere—Building on the Legacy of Austin Post

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

Advocate: Bruce F. Molnia

As a celebration of the legacy of Austin Post, papers are sought that demonstrate innovative uses of remote sensing, in the broadest sense, to provide new information about glaciers, sea ice, permafrost, river ice, and snow.

T55. Secondary Water Quality Effects of Natural and Enhanced Attenuation of Contaminants

Disciplines: Hydrogeology; Geochemistry; Geomicrobiology

Advocates: Isabelle M. Cozzarelli; Douglas B. Kent; Madeline E. Schreiber

Anaerobic conditions in contaminant plumes can create secondary plumes containing elements not present in the contaminant source. In this session, we will probe hydrologic and biogeochemical processes that control development and persistence of such secondary plumes.

T56. Streams and Aquifers: Integrating the Physical and Chemical

Disciplines: Hydrogeology; Geochemistry; Environmental Geoscience

Advocates: Christopher S. Lowry; Richelle Allen-King; Cailin H. Orr; C. Kent Keller

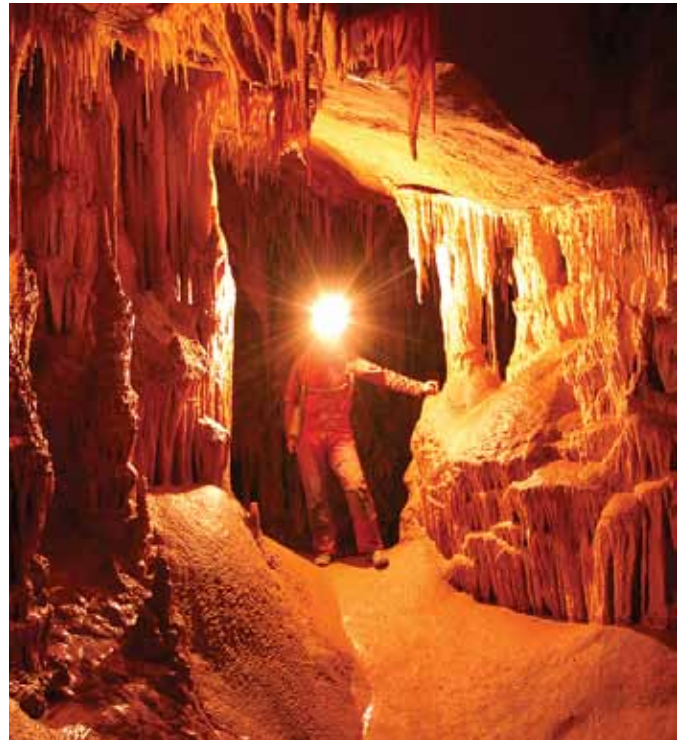
This session will present a range of research that inspires new methods or combinations of methods using physical and chemical sampling to better quantify surface/subsurface processes and interactions.

T57. Understanding Contaminant Fate and Transport in Unconsolidated Aquifers—A Session on the Occasion of 30 Years of Long-Term Research at the Cape Cod Toxic Substances Hydrology Field Site

Disciplines: Hydrogeology; Geomicrobiology; Geochemistry

Advocates: Richard L. Smith; Douglas B. Kent; Denis LeBlanc

Presentations are solicited that advance our understanding of contaminant transport and interactions in unconsolidated aquifers. Especially welcome are presentations with field components, from laboratory studies with field materials to theoretical studies with field applications.



KARST

T58. 125 Years Underground: A Retrospective and Prospective of Cave and Karst Research

Advocates: George Veni; Lewis Land

Caves and karst were once viewed as geologic curiosities but are now recognized as important features and terrains. This session reviews 125 years of cave/karst science, emphasizing the last 50 years, and looks toward future advancements.

T59. Assessing Hazards and Groundwater Contamination in Karst

Disciplines: Karst; Hydrogeology; Engineering Geology

Advocate: Yongli Gao

Groundwater contamination and hazards such as sinkholes are the two most common environmental concerns in karst lands. This session focuses on advancements in technology and approaches for hazard assessment and contamination investigation in karst areas.

T60. Caves as Deep Time Repositories of Geological, Biological, and Anthropological Information

Disciplines: Karst; Paleoclimatology/Paleoceanography; Hydrogeology

Advocates: Joshua M. Feinberg; E. Calvin Alexander

Caves serve as deep-time repositories of scientific information. This session welcomes contributions utilizing cave deposits to create time series of original data that capture information about the evolution of geologic, biologic, and anthropological systems.

T61. Karst 2.0: Orogenies and Glaciers and Faulting—Oh My! The Impact of Changing Geologic Conditions on Existing Karst Terrane and the New Tools and Techniques We Have to Study It
Disciplines: Karst; Geomorphology; Hydrogeology
Advocate: Cory W. Blackeagle

Once established, how does karst terrain change in response to subsequent changes in its region's geologic setting? How are those changes from initial conditions recognized? What cutting-edge technologies are being used in karst research today?

T62. The Epikarst as a Boundary and Critical Zone

Disciplines: Karst; Hydrogeology; Geochemistry
Advocates: Benjamin F. Schwartz; Madeline E. Schreiber

We welcome work on epikarst, including modeling, field studies, and novel method developments, that advances our understanding of hydrobiogeochemical processes, physical constraints, and environmental controls on epikarst function as a surface-subsurface boundary and critical zone.

T63. Transport and Transformation of Non-Solute Materials in Karst Aquifers

Disciplines: Karst; Hydrogeology; Environmental Geoscience
Advocates: Ellen K. Herman; Michael Sinreich; Dorothy J. Vesper

This interdisciplinary session focuses on innovative studies and techniques related to the transport and transformation of non-solute materials in karst waters. We invite abstracts related to sediments, particulate-tracers, contaminants (especially non-aqueous phase liquids), and biota.

LIMNOGEOLOGY

T64. Lacustrine Basin Analysis and Petroleum Systems: Ancient Case Studies, Modern Analogs, New Frontiers

Disciplines: Limnogeology; Stratigraphy; Petroleum/Energy
Advocates: Michael M. McGlue; Geoffrey Ellis

This session will encompass the evolution of our understanding of lacustrine geology, including research on the geology, geochemistry, and geophysics of lake basins (modern and ancient), with special relevance to petroleum systems development.

T65. Lakes and Lake Deposits on Earth and Mars

Disciplines: Limnogeology; Planetary Geology; Remote Sensing/ Geographic Info System

Advocate: Nathalie Cabrol

Remote sensing and observer data indicate that lake deposits are common on Mars. We invite papers on comparative paleolimnology between Mars and Earth, including sediment mineralogy, lake water geochemistry, and modern terrestrial analogs for Mars lakes.

T66. New or Improved Proxy Methodology for Enhanced Resolution and Accuracy of Climatic and Paleoenvironmental Interpretations in Sedimentary Records

Advocates: Michael Sperazza; Amy Myrbo

This session will serve as an examination of advances in climatic and environmental proxies to enhance our understanding and the accuracy of interpretations.

T67. West of the Plains, North to Alaska: The Role of Montane Lake, Bog, Fen, and Soil Records in Unraveling Climate Change in Western North America

Disciplines: Limnogeology; Environmental Geoscience; Quaternary Geology

Advocates: Scott W. Starratt; Paula Noble; Jennifer Kusler

One of the major challenges to understanding the impact of climate change in mountainous regions is identifying the impact of local factors on climate history. This session seeks biotic and abiotic records of these changes.

T68. World of Lakes

Disciplines: Limnogeology; Paleoclimatology/Paleoceanography
Advocate: Amy Myrbo

Lacustrine records continually provide new insights into terrestrial paleoconditions. Limnogeology and paleolimnology have taken tremendous strides in the past 50 years. This session invites all contributions related to lake research.

MARINE/COASTAL SCIENCE

T69. Learning from the Impacts of Superstorm Sandy

Disciplines: Marine/Coastal Science; Paleoclimatology/ Paleocceanography; Environmental Geoscience

Advocates: E. Christa Farmer; J. Bret Bennington; Steven Leone

How are data collected on the track, winds, storm surge, flooding, and sedimentation associated with hurricane/post-tropical cyclone Sandy being used to better understand past storms and predict future storms and their impacts?

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Aerial view of Glenwood Canyon, Colorado, rockslide onto Interstate 70, March 2010. Photo by CDOT, used with permission from the USGS.

ENGINEERING GEOLOGY

T70. Advances in Principles and Practice of Engineering Geology During the Past 50 Years

Disciplines: Engineering Geology; Geomorphology; Quaternary Geology

Advocates: William H. Schulz; Dennis M. Staley

Advances in tools and techniques for evaluating data and modeling improve the ability of engineering geologists to mitigate hazards and adverse geologic conditions. We encourage presentations on advances in principles and practices of engineering geology.

T71. Capturing Variability and Uncertainty in Geology for Risk Assessment and Reliability-Based Design

Disciplines: Engineering Geology; Geoscience Information/Communication; Geology and Public Policy

Advocates: Norman S. Levine; Samantha E. Hansen; Jeffrey R. Keaton; Matthew B. Morris

Geologists use dashed and queried lines to represent variability and uncertainty, but these aspects are not documented or quantified for communication with non-geologists. This session will focus on capturing and communicating uncertainty for broad use.

T72. Debris Flows

Disciplines: Engineering Geology; Geomorphology

Advocates: Jason W. Kean; Brian W. McArdell; Richard M. Iverson

We encourage submissions related to all aspects of debris-flow research, including debris-flow mechanics and modeling, controlled experiments, field observations, mitigation strategies, early warning, and effects on landscape evolution.

T73. GIS and Remote Sensing Applications in Environmental and Engineering Geology

Disciplines: Engineering Geology; Environmental Geoscience; Remote Sensing/Geographic Info System

Advocates: Norman S. Levine; John Chadwick; Khalid A. Ali

GIS and remote sensing technologies are essential tools in environmental and engineering geology. This session will highlight case studies and cutting-edge applications of the technologies for visualization and interpretation of applied geologic problems.

T74. Landslide Evolution: Long-Term Studies of Landslides and the Realities (or Surprises) They Reveal

Disciplines: Engineering Geology; Geomorphology; Hydrogeology

Advocates: Jeffrey A. Coe; Mark E. Reid

We encourage abstracts on long-term or multiple-event studies of all types of landslides or landslide terrains that use instrumental or observational monitoring, multi-temporal imagery, experimental apparatus, dating of past activity, or predictions of future behavior.

T75. Landslide Inventories, Data Dissemination, and Risk Reduction

Disciplines: Engineering Geology; Geomorphology; Environmental Geoscience

Advocates: Matthew M. Crawford; William J. Burns; Lynn M. Highland

This session is designed to highlight landslide inventories and how landslide hazard information is effectively delivered to different audiences that can apply it to risk reduction.

ENVIRONMENTAL GEOSCIENCE

T76. A Century of Geoscience on National Forests and Grasslands—Stewardship, Education, and Research

Advocates: Christopher P. Carlson; Michael A. Crump; Melody R. Holm; Joseph T. Gurrieri

This session will feature geologic resources and geoscience research conducted on U.S. National Forests and Grasslands. Topics include paleontology, geomorphology, hydrogeology, geo-ecology, geologic hazards, cave and karst resources, geologic engineering, and interpretive and recreational geology.

T77. Environmental and Social Implications of Hydraulic-Fracturing–Driven Oil and Gas Development: Toward a More Holistic Assessment

Disciplines: Environmental Geoscience; Geology and Public Policy

Advocates: Zachary H. Bowen; Victor M. Heilweil; Peter B. McMahon; Christopher J. Potter; Avner Vengosh

This session provides a forum for those studying the environmental and socioeconomic effects of hydraulic-fracturing–driven oil and gas development to share their research and experience and to discuss new approaches for doing coordinated assessments.

T78. Environmental Impacts of Coal Utilization

Disciplines: Environmental Geoscience; Geochemistry; Coal Geology

Advocates: Laura Ruhl; Amrika Deonarine

This session explores the environmental impacts associated with coal utilization. Relevant topics include fate of coal combustion byproducts, emissions from coal fired power plants, and environmental and health impacts of coal mining.

T79. Geochemical Mapping at Regional to Continental Scales

Disciplines: Environmental Geoscience; Geochemistry; Geology and Health

Advocates: David B. Smith; Laurel G. Woodruff

This session will focus on results from regional- to continental-scale geochemical mapping studies conducted for either mineral exploration or environmental management. The emphasis will be on broad-scale studies, but we also welcome presentations from more local- or site-specific investigations.

T80. Geology for the Common Good: Sustainable Resources for the 21st Century

Disciplines: Environmental Geoscience; Economic Geology; Geology and Public Policy

Advocate: Gregory R. Wessel

This session focuses on the future of mineral and energy resource utilization, how mining can evolve to become part of a sustainable economy, unconventional and waste-stream recovery, and the resulting challenges faced by geoscientists.

T81. Geomorphology and Hydrology Impacts from Wildfires: Advances in Our Understanding over the Last 50 Years

Disciplines: Environmental Geoscience; Geomorphology; Engineering Geology

Advocates: Jerome V. De Graff; Paul Santi; Dennis M. Staley

An examination of advances and continuing problems in understanding, modeling, and predicting how wildfire promotes changes in the landscape, resulting in flood and debris flow hazards.

T82. Geosciences and International Development

Disciplines: Environmental Geoscience; Hydrogeology; Geology and Health

Advocates: Jeffrey Greenberg; J.E. Fryxell; Gary T. LaVanchy

This session offers presentations describing the application of geological principles for the improvement and solution of problems involving natural resource availability, environmental health, and land-use practices.

T83. Impact of Winter De-Icing Chemicals on Water Quality and the Environment

Disciplines: Environmental Geoscience; Hydrogeology; Geochemistry

Advocate: Rudolph Hon

De-icing and anti-icing chemicals applied to road surfaces cause increasing levels of Cl and Na in GW/SW in the northern snow-belt states. This session seeks new studies and results on this subject.

T84. Impacts of Climate Change on Human Populations: Water, Food, Health, Living Space

Disciplines: Environmental Geoscience; Geology and Health; Geology and Public Policy

Advocates: George T. Stone; Michael E. Mann; Stanley R. Riggs

This session seeks to attract compelling studies by leading researchers that document and predict the past, present, and future impacts of significant and rapid climate change on human populations.

T85. International Development and the Geosciences

Disciplines: Environmental Geoscience; Geology and Health; Hydrogeology

Advocate: Gary T. LaVanchy

The role of geosciences within international development has historic significance and expanding potential to serve the global needs of people and their environment. We invite papers that speak to the role and/or impact of geosciences within an international development context.

T86. Intersections of Sustainability and Geosciences

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

Advocates: Leslie North; Robert Brinkmann

Abstracts are sought for a special session on sustainability and the geosciences. The session seeks to highlight the work of researchers that combine the fields of sustainability and geoscience to examine environmental and/or societal problems.

T87. New Perspectives on Quaternary Paleocology and Paleoclimatology in Western North American Deserts

Disciplines: Environmental Geoscience; Paleoclimatology/ Paleooceanography; Quaternary Geology

Advocate: Andrea Brunelle

This session will explore the dynamic nature and evolution of western North American desert environments and climates during the Quaternary. New records utilizing all types of proxies are welcome.

T88. Pyrogenic Black Carbon, or Biochar, in Soils and Sediments, Its Characterization and Fate, Its Effects on the Carbon Cycle and Carbon Sequestration, and Its Effects on Soil Properties

Disciplines: Environmental Geoscience; Geochemistry, Organic
Advocates: Colleen E. Rostad; David W. Rutherford

This session addresses pyrogenic carbon in soils and sediments. The presence of this material can have profound effects on the nature of soil and an increasing role to play in carbon sequestration.

T89. The Sandy Beaches of Atlantis: Success Stories and Cautionary Tales for Coastal Development

Disciplines: Environmental Geoscience; Engineering Geology; Geology and Public Policy

Advocates: R. Laurence Davis; Stephen G. Pollock; Robert Young

Coastal development practices frequently increase exposure to geologic hazards. This session will examine case studies that exemplify “good” and “bad” approaches to coastal development and long-term climate change adaptation along with implications for public policy.

GEOINFORMATICS

T90. Digital Geosciences: A Framework for Data-Intensive, Multi-Disciplinary Research and Education

Disciplines: Geoinformatics; Geoscience Information/Communication; Remote Sensing/Geographic Info System

Advocates: M. Lee Allison; Kerstin A. Lehner

Efforts are underway to integrate rapidly growing data streams and technologies into an open, adaptable, sustainable framework for data-intensive, multidisciplinary geoscience research compatible with high-performance computing, large and small data sets, scalable software, and modeling.

T91. Geological and Geomorphological Applications of Digital Terrain Analysis

Disciplines: Geoinformatics; Remote Sensing/Geographic Info System; Geomorphology

Advocates: Carlos Henrique Grohmann; Christopher J. Crosby

Digital terrain data provide insight into Earth’s topography, allowing quantification of processes and spatial relationship of features. We welcome contributions highlighting advances in methods, algorithms, and applications of digital terrain analysis to geology and geomorphology.

T92. Societal Impacts of Multidimensional Geoscience Models: Defining Geological Concepts and Conveying Implicit and Tacit Knowledge

Disciplines: Geoinformatics; Environmental Geoscience; History and Philosophy of Geology

Advocates: A. Keith Turner; Holger Kessler; Norman S. Levine; Michiel van der Meulen

This session demonstrates examples of geological modeling studies that rely upon implicit and/or tacit geological knowledge with case studies showing effective working practices, software functionality, and successful model outcomes, as well as lessons learned.



GEOLOGY AND HEALTH

T93. Erionite in the USA

Disciplines: Geology and Health; Environmental Geoscience; Mineralogy/Crystallography

Advocate: A. Umran Dogan

Erionite is the most carcinogenic mineral and devastated the lives of three villages in Turkey with over 50% mesothelioma. Recently, a few mesothelioma cases have been reported outside Turkey. Erionite and its relationship to mesothelioma must be investigated quantitatively.

T94. How Geology Can Cure the Common Cold: The Intersection between Geology, Health, and Society

Disciplines: Geology and Health; Geoscience Information/Communication; Geoscience Education

Advocate: Julia Linnaea Wise

This session will communicate the value of geoscience input in public health by highlighting examples of successful applications of the geosciences in solving problems from and furthering discovery in the medical and public health fields.



T95. Recent Advances in Medical Geology

Disciplines: Geology and Health; Environmental Geoscience; Geochemistry

Advocates: Saugata Datta; Nurdan S. Duzgoren-Aydin; Thomas Darrah

This session aims to increase the profile of medical geology and integrate multidisciplinary research approaches that span the geology and health disciplines.

T96. Water-Quality Constraints on Groundwater Availability and Use—What Are the Trade-Offs or Costs to Society?

Disciplines: Geology and Health; Hydrogeology; Environmental Geoscience

Advocates: Kelly Warner; Barbara J. Mahler

This session brings together hydrogeologists, economists, public-health specialists, and others investigating the linkage between groundwater quality and availability, from regional to local scales, using approaches from hydrologic modeling to economic analysis.

ECONOMIC GEOLOGY

T97. Evolution of REE-Enriched Carbonatite-Alkalic Rock Systems: In Honor of Daniel R. Shawe

Disciplines: Economic Geology; Petrology, Igneous; Geochemistry

Advocates: Ed DeWitt; Wayne R. Premo

Studies of deposits throughout the world are welcome, including research on magmatic and hydrothermal mineral deposits, mineralogy, whole rock and isotope geochemistry, geochronology, geophysics, tectonic setting, source regions, weathering, and formation of supergene deposits.

T98. Recent Advances and Applications of Isotope Geochemistry and Geochronology to Ore Deposit Studies

Disciplines: Economic Geology; Geochemistry

Advocates: Matthew E. Bruesek; George D. Kamenov; Ryan Mathur; James A. Saunders

Research on ore deposits is becoming increasingly important as society relies on technology that utilizes deposit resources. This session will highlight all aspects of ore deposit formation, with an emphasis on contemporary approaches utilizing geochronology and isotope analyses.

T99. Sediment-Hosted Base Metal Deposits

Disciplines: Economic Geology; Geochemistry

Advocates: J. Richard Kyle; Martin Appold

This session aims to highlight current research on the characterization and origin of the diverse types of base metal deposits that have formed within sedimentary basins throughout geologic history.

T100. What's Left? Hands on with the Results of the First Global Mineral Resource Assessment (Digital Posters)

Disciplines: Economic Geology; Remote Sensing/Geographic Info System; Geology and Public Policy

Advocate: Jane M. Hammarstrom

Highlights of the first global assessment of undiscovered resources of copper, platinum-group elements (PGE), and potash: Identified resources, estimates of undiscovered resources, regional assessment results, new tools for assessment, and applications to societal issues.



COAL GEOLOGY

T101. Celebrating 125 Years of Coal and Source Rock Science: From Fundamental Principles to Applied Technology

Disciplines: Coal Geology; Environmental Geoscience; Petroleum/Energy

Advocates: Jennifer M.K. O'Keefe; Mark A. Engle; Victoria Hudspeth

This session highlights recent advances in coal science. Topics include, but are not limited to, characterization of coal and coal combustion products, organic petrology, coal gasification/liquefaction, coalbed methane, carbon sequestration, paleoecology, stratigraphy, and sedimentology.

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GEOPHYSICS/TECTONOPHYSICS/ SEISMOLOGY

T102. Advances in Humanitarian Applications of Shallow- Subsurface Imaging

Disciplines: Geophysics/Tectonophysics/Seismology; Geoscience Education; Environmental Geoscience

Advocate: Gregory S. Baker

Near-surface geophysics (NSG) involves remote imaging of the upper 200 m of Earth's subsurface utilizing sophisticated equipment. There is a significant recent push to expand the humanitarian applications of NSG. Applied examples will be highlighted.

T103. Fluids, Stress, and Episodicity in Subduction Settings: What We Need to Know

Disciplines: Geophysics/Tectonophysics/Seismology; Hydrogeology; Economic Geology

Advocates: Jeffrey W. Hedenquist; Lawrence M. Cathles; Kéiko H. Hattori

Fluids are ubiquitous in subduction settings, involved with metamorphism, magmatism, seismicity, the formation of metal deposits, etc. This multidisciplinary session will examine what we need to know to understand episodic fluid movement.

T104. From Mantle to Mountains: Cenozoic Evolution of the Interior West

Disciplines: Geophysics/Tectonophysics/Seismology; Geomorphology; Tectonics

Advocates: Joel Pederson; Rebecca Flowers; Brandon Schmandt

Recent multidisciplinary research is transforming our understanding of the evolution and causes of the Interior West's seminal landscapes. This session will link diverse studies of deep and surficial systems important to regional Cenozoic landscape evolution.

T105. Geophysical Investigations of Geological Hazards

Disciplines: Geophysics/Tectonophysics/Seismology; Engineering Geology; Geology and Public Policy

Advocates: Bruce D. Smith; Kevin L. Mickus

This session explores the use of geophysical methods in the analysis of geological hazards including, but not limited to, volcanoes, karst, landslides, tsunamis, and earthquakes.

T106. Geophysical/Remote Sensing Characterization of Rare Earth Element and Other Critical Mineral Deposits

Disciplines: Geophysics/Tectonophysics/Seismology; Remote Sensing/Geographic Info System; Economic Geology

Advocates: Anne E. McCafferty; Anjana K. Shah

Geophysical surveys are key to the discovery and characterization of REE and critical mineral deposits. This session encourages innovative analyses of geophysical and complimentary petrophysical and mineralogical studies that contribute to understanding these important deposits.

T107. Integrated Geologic and Geophysical Studies of Hydrothermal Systems in Extensional or Transtensional Settings

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

Advocates: Jonathan Glen; Anne E. Egger; Wendy Calvin

This session focuses on integrated geologic and geophysical studies investigating the kinematic and structural controls on hydrothermal systems in extensional settings, including case histories, modeling, and technology, or theoretical developments.

T108. Combining Geophysics and Geology: The George P. Woollard Award Session

Disciplines: Geophysics/Tectonophysics/Seismology; Tectonics

Advocates: Audrey Huerta; Samantha E. Hansen

This session honors the recipient of the George P. Woollard Award for his or her outstanding geophysics contributions that advance our understanding of geology. Contributions combining geophysics and geology to solve geologic problems are welcome.

T109. Origin of Tectonic Plates Movement Due to Effect of the Coupling of Diurnal Pulsating Hydro-Magneto-Thermo-Mechanical Load and Forced Convection System into the Mantle Generated from Inside Out the Earth Based on the Pulsating Mantle (Earth) Hypothesis (Digital Posters)

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

Advocates: Hassan Gholibeigian; Abdolazim Amir Shahkarami

Discussions in this session will be about the root causes of the movement of tectonic plates. Here, the Pulsating Mantle Hypothesis, which was presented in 2012 at the AGU Fall Meeting (PA23A-1960), helps us with plate tectonics theory development.

T110. Pedagogical Applications of Near-Surface Geophysics

Disciplines: Geophysics/Tectonophysics/Seismology; Geoscience Education; Environmental Geoscience

Advocate: Gregory S. Baker

Near-surface (upper 200 m) geophysical techniques can offer students the unique opportunity to fully experience the scientific method through developing questions (hypotheses), planning a survey, conducting a survey, processing data, and generating interpretations. Pedagogical innovations will be highlighted.

T111. The Structure and Evolution of the North American Lithosphere: An Integrated Perspective

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

Advocates: Kevin Mickus; G. Randy Keller

Geophysical methods have been instrumental in our understanding of the evolution of the North American lithosphere. This session will present examples of integrated investigations of the structure and evolution of the North American lithosphere.

T112. Use of Seismic Models in Non-Seismology Studies

Disciplines: Geophysics/Tectonophysics/Seismology; Tectonics; Geochemistry

Advocates: Will Levandowski; Craig Jones

This session aims to convene workers in a variety of fields who make use of seismic models, especially quantitatively, in addressing broader tectonic or dynamic questions.



GEOSCIENCE EDUCATION

T113. 16 Years of GeoCorps™—Geoscience Projects Impacting America's Public Lands and Natural Resources

Disciplines: Geoscience Education; Hydrogeology; Paleontology, Biogeography/Biostratigraphy

Advocates: Matthew Dawson; Elizabeth Norby

GSA's GeoCorps America program has been going strong since 1997. This session highlights some of the many impacts GeoCorps projects have had on America's public lands, including National Parks, National Forests, and Bureau of Land Management sites.

T114. Changes in the Undergraduate Research Experience over Time: Perspectives from Individual Mentors, Departments, and Institutions (Posters)

Disciplines: Geoscience Education; Geoscience Information/Communication

Advocates: Laura A. Guertin; P. Lee Phillips; Dan K. Moore

With advances in technology, increased field access, changes in funding, increased interdisciplinary work, etc., undergraduate research mentoring and programs have changed. This session encourages submissions from mentors, departments, and institutions to describe evolving practices.

T115. Climate Literacy: Formal and Informal Education and Community Outreach Efforts to Enable Responsible Decisions

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

Advocates: Tamara Shapiro Ledley; Susan Buhr; Jeffrey Ryan

Abstracts focusing on descriptions of efforts for pre-college (students & teachers), higher education, informal education audiences, and community outreach, including materials, activities, curriculum, capstone projects, service learning, professional development programs, and community activities, are encouraged.

T116. Climate Literacy: Research and Evaluation Results from Informal and Formal Climate Education Efforts

Discipline: Geoscience Education

Advocates: Anne Gold; Karen McNeal

This session focuses on what education, social, and cognitive research and project evaluation can tell us about misconceptions and incorrect mental models that hinder the understanding of the complex climate system.

T117. Developing and Sustaining Thriving Geoscience Programs and Departments: Strategies and Examples from Two-Year and Four-Year Colleges and Universities

Discipline: Geoscience Education

Advocates: Lynsey E. LeMay; R. Heather Macdonald; Peter J. Berquist

Strategies for developing and sustaining thriving geoscience programs are varied across institution types, yet much can be learned from shared successes. Suggested topics include issues related to faculty, including adjuncts, students, building curriculum, and administration.

T118. Developing Exemplary Support Programs for K–12 Geoscience to Meet Next Generation Science Standards

Discipline: Geoscience Education

Advocate: Michael J. Passow

Learn how geoscience societies, agencies, universities, and informal science institutions will provide significant support as states and schools implement the Next Generation Science Standards and new STEM (Science-Technology-Engineering-Math) curricula.

T119. Digital Geology Express (Digital Posters)

Disciplines: Geoscience Education; Geoscience Information/Communication; Geoinformatics

Advocates: Declan G. De Paor; Stephen J. Whitmeyer; John Bailey; Callan Bentley

A modification of the speed-dating format from GSA 2012, this fast-paced session will link presenters and active participants in a blend of digital poster and workshop formats.

T120. Dual-Credit Classes and Other Collaborative Strategies for Recruiting High School Students into College Geoscience Programs

Discipline: Geoscience Education

Advocates: Dirk Baron; Raymond V. Ingersoll; Janice M. Gillespie

We encourage contributions on dual-credit/concurrent-enrollment geoscience classes taught at high schools and supported by college faculty as well as on other successful collaborations for recruiting high school students into geoscience majors.

T121. Educating the Next Generation of Geoscientists: Effective Strategies That Engage Students, Invest in the Future Geoscience Workforce, and Increase Participation of Members of Historically Underrepresented Communities in the Geosciences

Disciplines: Geoscience Education; Geoscience Information/Communication

Advocates: Shondricka Burrell; Diane F. Maygarden; Lisa D. White

This session highlights uniquely designed practices that engage underrepresented students in the geosciences and is open to faculty, mentors, and students interested in sharing effective strategies, measured results, and forward-looking thoughts on advancing the geosciences.

T122. Geoheritage and Sense of Place in the Context of Earth Science Education

Disciplines: Geoscience Education; Geoscience Information/Communication

Advocates: Erika C. Vye; William I. Rose; Tom Casadevall

This session aims to address the value of geoheritage and sense of place for earth-science education in an effort to more fully address gaps in the public's fundamental understanding of earth science.

T123. Geology in the National Parks: Research, Mapping, and Resource Management

Disciplines: Geoscience Education; Geoscience Information/Communication

Advocates: Bruce Heise; Jason P. Kenworthy; Timothy B. Connors

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

T124. Geoscience Alliance: Moving Toward Earth Systems Planning for Seven Generations through Broadening the Participation of Native Americans in the Geosciences

Disciplines: Geoscience Education; Geology and Public Policy; Environmental Geoscience

Advocates: Nievita Bueno Watts; Diana Dalbotten; Suzanne Zurn-Birkhimer; Amy Myrbo

Geoscience Alliance was formed in 2007 as a national movement dedicated to broadening the participation of Native Americans in

the geosciences through innovative programming and research. We will highlight our progress and discuss remaining challenges.

T125. Geoscience Education and Outreach: 50 Years of Progress

Disciplines: Geoscience Education; Geology and Public Policy; History and Philosophy of Geology

Advocates: Cathryn Manduca; Eugene F. Pearson

This session will highlight significant changes that have occurred in informal and formal geoscience education and outreach programs during the past 50 years and the organizations (governmental and professional) that facilitate them.

T126. Geoscience Learning and Practice Enabled through Cyberinformatics and Technology

Disciplines: Geoscience Education; Geoscience Information/Communication; Geoinformatics

Advocates: Thomas F. Shipley; Bridget Garnier; Basil Tikoff

The goal of this session is to present new advances in cyberinformatics and technology that have opened new avenues to teaching geoscience more effectively as well as help students and professionals learn more effectively.

T127. Great Geological Field Trips

Disciplines: Geoscience Education; History and Philosophy of Geology; Structural Geology

Advocates: Douglas W. Haywick; David T. Allison

This session will highlight participants' most memorable geology field trips. Excellent geology, unique locations, well-run events, or extraordinary leaders are all welcome subject matter.

T128. Historical Perspectives and Modern Approaches of Access and Inclusion in the Geosciences

Disciplines: Geoscience Education; History and Philosophy of Geology; Geology and Health

Advocates: Christopher Atchison; Sharon Locke

Geoscience students and educators are encouraged to disseminate current and historical research findings and instructional experiences that promote the enhancement of diverse participation in the geosciences through increased access and inclusion.

T129. Innovative Geoscience Teacher Professional Development: Design, Implementation, Evaluation

Discipline: Geoscience Education

Advocates: Mark F. Klawiter; William I. Rose; Ashley E. Miller

This session will feature design and implementation of innovative methods of field, classroom, and/or virtual professional development for K-12 geoscience teachers, including evaluative methods for documenting effectiveness.

T130. Status of Undergraduates and K–12 Students—Involved Geoscience Research: Impact on Science and Society (Posters)

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

Advocate: Nazrul I. Khandaker

This session marks a decade-long (2004–2013) continuity and efforts to reach out to potential undergraduates and K9–12 students involved in geoscience-related research. It is open to anyone who cares about landscape, natural resources, water, and hot environmental topics.

T131. Stepping out of the Box to Put Rocks in the Heads of Non-Majors: Do Creative Teaching Techniques Enhance Learning in Post-Secondary Introductory Geology Courses?

Discipline: Geoscience Education

Advocate: Barbara EchoHawk

What evidence supports or refutes the effectiveness of teaching geology for non-majors through “non-traditional” approaches such as art-, place-, or event-based learning, student-centered learning, or instruction designed for specific learning styles?

T132. Strategies to Support Part-Time Faculty in Two-Year and Four-Year College Geoscience Programs

Discipline: Geoscience Education

Advocates: Laura A. Lukes; Suzanne T. Metlay

Part-time faculty often provide the majority of introductory geoscience instruction at two-year and four-year colleges, includ-

ing online and off-campus programs. This session highlights successful strategies for supporting part-time faculty with instructional, administrative, and community resources.

T133. Teaching Controversial Subjects in K–16 Geoscience Classrooms: Balancing the Rights and Roles of Students, Instructors, Parents, Scientists, Industry, and Community in Producing a Scientifically Literate Society for the 21st Century

Disciplines: Geoscience Education; History and Philosophy of Geology; Geology and Public Policy

Advocates: Sadredin C. Moosavi; Don Duggan-Haas

This session explores techniques, strategies, and limitations to teaching controversial subjects in geoscience classrooms in light of evolving scientific understanding, educational standards, and the roles and rights of diverse stakeholders in scientific literacy efforts.

T134. The “Next Generation Science Standards” and the Future of Earth and Space Science Education

Disciplines: Geoscience Education; Geoscience Information/Communication

Advocate: Michael E. Wysession

The Next Generation Science Standards represent the first attempt at a national set of K–12 science education standards in the U.S. This session explores their potential impacts on U.S. K–16 earth and space science education.

Let us help you arrange space for your event
2013 Annual Meeting Space Requests



Deadline: 5 June 2013

Please let us know about your non-technical events by submitting them through our online space request system at www.geosociety.org/meetings/2013/. This includes all events that you would like listed in the program and on the personal scheduler. All meeting room assignments will be made by GSA; we will notify you of your room assignment in July. If you are holding an off-site event, please submit it through the online space request system as well to ensure that it is included in the program book.

www.geosociety.org/meetings/2013/

T135. The Future of the Geoscience Workforce: Preparing for Traditional and Non-Traditional Geoscience Careers

Disciplines: Geoscience Education; Geoscience Information/Communication

Advocates: Carolyn Wilson; Eric M. Riggs

This session discusses the many diverse career paths and occupations students can pursue with geoscience degrees and aims to facilitate discussion within the audience about how to think about the geoscience job market differently.

T136. Training, Assessment, and Outreach That Enhance Communication of Geosciences for Formal and Informal Audiences

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

Advocates: Karen S. McNeal; Heather Miller; Sarah P. Radencic

Effective communication of geosciences can be accomplished through a combination of diverse and unique methods. This session focuses on training, assessment, and outreach strategies for improving communication of geosciences to formal and informal audiences.

T137. Undergraduate Research Experiences at the Introductory Level in Two- and Four-Year Colleges

Discipline: Geoscience Education

Advocates: Katrien J. van der Hoeven Kraft; David H. Voorhees

This session explores successes and challenges in implementing research or research experiences applying scientific methods with first- and second-year students at two- and four-year colleges. Projects of all types and lengths are welcome.

T138. Undergraduate Research Talks: The Next Step in Student Research Projects

Discipline: Geoscience Education

Advocates: Bradley G. Johnson; Jacqueline A. Smith; Edward C. Hansen

This session provides undergraduate students with a venue for presenting completed research projects. We encourage students to submit abstracts for research projects in any subdiscipline of geology or earth science.

*Don't miss being a part of
GSA's 125th Anniversary!*



**GEOSCIENCE INFORMATION/
COMMUNICATION**

T139. Advancing Scientific Communication: Looking Forward on the Occasion of Our 125th Anniversary

Disciplines: Geoscience Information/Communication; Geology and Public Policy; Geoscience Education

Advocates: Justin M. Samuel; Christa M. Stratton; Kasey S. White

This session will bridge disciplines by bringing together scientists, policy makers, journalists, and other professional communicators to examine and improve science communication and to focus on the dynamics of effective engagement between geoscientists and society.

T140. Confronting Complexity: Rethinking the Future of Geoscience Information

Disciplines: Geoscience Information/Communication; Geoscience Education

Advocate: Hannah Winkler

In celebration of GSA's 125th Anniversary, this session will examine ways librarians and other information professionals are supporting new disciplines and celebrating the use of new technologies in the geosciences.

T141. Geologic Mapping—A Key to Successful Management of Water and Land Resources

Disciplines: Geoscience Information/Communication; Hydrogeology; Engineering Geology

Advocates: Richard C. Berg; Jon Ford; Peter T. Lyttle; E. Donald McKay; Hazen A.J. Russell; David R. Soller; Harvey Thorleifson

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.

T142. Geologic Maps and Their Derivatives (Posters)

Disciplines: Geoscience Information/Communication; Hydrogeology; Engineering Geology

Advocates: Richard C. Berg; Ralph F. Crawford; Michael W. Higgins; Linda Jacobsen; E. Donald McKay; Hazen A.J. Russell; David R. Soller; Harvey Thorleifson; Jon Ford

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.

T143. Geoscience Across Cultures and Communities: Benefits and Challenges of Diversity

Disciplines: Geoscience Information/Communication; Geology and Public Policy

Advocates: Marilyn J. Suiter; Richard C. Berg

The session is on people and practices that have contributed to our increasing understanding of the importance of the role of diversity in the geoscience profession.

T144. Global Vision: Geoscience Information for the Future (Posters)

Disciplines: Geoscience Information/Communication; Geoscience Education; Geoinformatics

Advocate: Hannah Winkler

This session will highlight innovations in the global field of geoscience information through social impact and unique thought processes.

HISTORY AND PHILOSOPHY OF GEOLOGY

T145. Great Books in Geology

Disciplines: History and Philosophy of Geology; Tectonics; Stratigraphy

Advocates: Alan E. Leviton; Michele Aldrich

Papers assess books that are paradigm-setting or great “normal” science, summarizing contents, significance, and what made the book great as research, writing, theorizing, or analysis. The time frame for the session is 16th-century to recent.

T146. GSA: A 125th-Year Historical Reprise

Discipline: History and Philosophy of Geology

Advocate: James C. Dawson

This aims to be a broad and inclusive session on the contributions of GSA’s Divisions, Associated Societies, Sections, past officers, past awardees, and others to serve as a review of the history and contributions of GSA to geology since 1888.

T147. Dinosaurs & Diamonds: Celebrating 125 Years of Geoscience in Museums

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

Advocates: Richard A. Kissel; Samantha Richards

Natural history collections, including earth-science specimens, form a foundation for understanding the natural world and are gateways to inspiration. Museum displays of these collections are critical to society’s advancement now and in the future.

T148. The Colorado Scientific Society & 150 Years of Geologic Research in Colorado, II: Development of Geological Concepts and Studies in Colorado Geology

Disciplines: History and Philosophy of Geology; Volcanology; Tectonics

Advocates: Lisa Rae Fisher; Libby Prueher

Dive into the fascinating world of Colorado geology, its contribution to the development of geologic concepts, and the wide range of recent research crossing all topical studies, including volcanology, paleontology, structure, tectonics, and regional studies.

T149. The Parade of Geological Society of America Presidents

Disciplines: History and Philosophy of Geology; Geoscience Education

Advocates: Sally Newcomb; William R. Brice

The Geological Society of America has had 124 presidents in its 125 years of history. Their work represents the sequence of thought in our science. We welcome your investigations into their work.

GEOCHEMISTRY

T150. Advances in X-Ray Fluorescence and Diffraction and Their Role in Sedimentary Geochemistry and Chemostratigraphy

Disciplines: Geochemistry; Stratigraphy; Paleoclimatology/Paleoceanography

Advocate: Alexander Seyfarth

This session seeks to evaluate the role of X-ray fluorescence and diffraction in stratigraphy, paleoceanography, paleolimnology, paleopedology, and paleoclimatology and define modern approaches to answering questions in the various subdisciplines of sedimentary geochemistry.

T151. Biogeochemical Processes Affecting Metal and Metalloid Isotopes

Disciplines: Geochemistry; Environmental Geoscience

Advocates: David M. Borrok; Richard B. Wanty; Lev Spivak-Birndorf

This session will explore biogeochemical processes that affect metal isotope ratios in field and experimental studies. Emphasis will be placed on understanding the biogeochemical processes involved and the mechanisms by which isotope fractionations are facilitated.

T152. Celebrating the Scientific Contributions of Kirk Nordstrom—Part I: Acid to Neutral Mine Drainage, Geochemistry of Iron and Sulfur, Sulfate Minerals, Natural Background, and Geochemical Modeling

Disciplines: Geochemistry; Environmental Geoscience; Hydrogeology

Advocates: Kate M. Campbell; Philip L. Verplanck; Charles Alpers; R. Blaine McCleskey

This session honors the career achievements of Kirk Nordstrom, USGS hydrogeochemist, by exploring research on mine drainage and related studies, including iron and sulfur geochemistry, sulfate minerals, natural background in mining environments, and geochemical modeling.

T153. Celebrating the Scientific Contributions of Kirk Nordstrom—Part 2: Geochemistry of Arsenic and Antimony, Microbial Biogeochemistry, Geothermal Systems, Radioactive Waste Disposal, and Geochemical Modeling

Disciplines: Geochemistry; Environmental Geoscience; Hydrogeology

Advocates: Kate M. Campbell; Philip L. Verplanck; Charles Alpers; R. Blaine McCleskey

This session honors the career achievements of Kirk Nordstrom, USGS hydrogeochemist, by exploring research on arsenic/antimony speciation and redox transformations, microbial biogeochemistry, geothermal systems, water-rock interactions, radioactive waste disposal, and geochemical modeling.

T154. Coupling Colloid-Water Interfacial Geochemical Processes with Contaminant Transport: Micro Vehicles for Big Problems

Disciplines: Geochemistry; Environmental Geoscience; Hydrogeology

Advocates: Yu Yang; Tao Cheng

This session aims to cover experimental and modeling efforts to couple colloid-surface or colloid-mediated geochemical reactions with transport of contaminants (metals, radionuclides, organic contaminants) in geologic media.

T155. Dating the Prograde Path in Metamorphic Rocks: Methods, Advances, Limitations, and Applications

Disciplines: Geochemistry; Petrology, Metamorphic; Mineralogy/Crystallography

Advocates: Thomas D. Hoisch; Sean R. Mulcahy; Bradley R. Hacker

This session focuses on studies that involve methods for dating the prograde portion of heating-cooling paths in metamorphic rocks. Submissions to this session may be about any aspect, including advances, limitations, and applications.

T156. Forensic Geoscience: Advances and Applications

Disciplines: Geochemistry; Mineralogy/Crystallography; Archaeological Geology

Advocate: Elisa Bergslien

This session will serve as a forum for sharing active research projects or present case studies, including applications of geoscience research to the law and use of analytical techniques, geophysical tools, database development, provenance, remote sensing, disturbed stratigraphy, and other investigative techniques.

T157. Frontiers in Petrochronology

Disciplines: Geochemistry; Tectonics; Petrology, Metamorphic

Advocates: John Cottle; Andrew Kylander-Clark

This session will highlight advances in techniques that link in-situ textural/chemical/isotopic information with chronology of dateable phase(s). Contributions focusing on deconvoluting complex tectonic, metamorphic, or magmatic processes are encouraged.

T158. Geochemistry of Flowback and Produced Waters from Hydraulically Fractured Black Shale

Disciplines: Geochemistry; Environmental Geoscience; Petroleum/Energy

Advocates: Brian W. Stewart; Rosemary C. Capo; Carl S. Kirby

This session solicits papers focused on produced water from hydraulic fracturing of shales, including variations in water chemistry over time and space, sources of dissolved solids, geochemical fingerprinting, and produced water biogeochemistry.

T160. Hot Topics: Understanding Metamorphic Processes in the Middle to Lower Crust

Discipline: Geochemistry

Advocates: Andreas Möller; Nigel M. Kelly

We seek contributions on all aspects of high-temperature metamorphism, up to and including UHT-granulites, to elucidate the nature and evolution of the hot middle to lower crust using geochemical, petrological, geochronological, and modeling approaches.

T161. Hydrochemistry and Biogeochemistry of Tropical Mountainous Rivers & Estuaries

Disciplines: Geochemistry; Geochemistry, Organic; Limnogeology

Advocates: Steven T. Goldsmith; Russell Harmon; Ryan P. Moyer

We encourage contributions that examine the hydrochemistry of tropical mountainous rivers and/or the biogeochemical cycling and fluxes, as well as paleo-records, of material delivered by tropical mountainous rivers and associated estuarine and coastal waters.

T162. Interdisciplinary Studies across the Critical Zone

Disciplines: Geochemistry; Geomicrobiology; Hydrogeology

Advocates: JoAnn M. Holloway; Henry Lin; Martin B. Goldhaber; Jean M. Morrison

Interplay between biological, chemical, and physical processes is crucial to the function of the Critical Zone in regulating soil, water, and air quality. This session seeks presentations from soils, ecology, microbiology, hydrology, and biogeochemistry perspectives.

T163. Pedogenic Minerals as Indicators of Ecosystems: Understanding the Critical Zone through Space and Time

Disciplines: Geochemistry; Paleoclimatology/Paleoceanography; Sediments, Clastic

Advocates: Neil J. Tabor; Craig Rasmussen

This session will emphasize the occurrence and distribution of pedogenic minerals in response to a range of different soil-forming factors and how those minerals in paleosol profiles provide proxies of ancient critical zones and paleoenvironments.

T164. Recent Advances in Geochronology—Celebrating the 100th Anniversary of the Publication of the “The Age of the Earth” by Arthur Holmes

Disciplines: Geochemistry; Tectonics; Paleontology, Diversity, Extinction, Origination

Advocates: S.A. Bowring; Sidney R. Hemming; J. Douglas Walker

This session focuses on advances in geochronology that yield high precision and accurate dates used to establish the geologic time scale from the oldest rocks to rates and durations of evolutionary and geological change.

T165. Sigma Gamma Epsilon Undergraduate Research (Posters)

Disciplines: Geochemistry; Stratigraphy; Hydrogeology

Advocates: Erika R. Elswick; James C. Walters

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.

T166. Sources, Transport, Fate, and Toxicology of Trace Elements and Organics in the Environment

Disciplines: Geochemistry; Environmental Geoscience; Geology and Health

Advocates: David T. Long; LeeAnn Munk; W. Berry Lyons

Basic and applied research on trace elements and organics in the environment are encouraged. Topics include those that relate to understanding and modeling sources; transport and fate; human and ecosystem health; and environmental assessment and remediation.

T167. The Road to Recovery—The Nature of Biotic and Geochemical Cycles During the Early Triassic

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

Advocates: Stephen E. Grasby; Benoit Beauchamp

Rather than a prolonged recovery period, the Early Triassic is better characterized by profound shifts in global biogeochemical cycles that repeatedly aborted recovery attempts. Studies on biotic recovery patterns, marine geochemistry, and potential drivers of this chaotic period are welcome.

T168. Urban Geochemistry

Disciplines: Geochemistry; Environmental Geoscience; Geology and Health

Advocates: W. Berry Lyons; David T. Long

This session encourages presentations that qualify and quantify the geochemical and biogeochemical impacts of urbanization and urban activities on soil, water, and air resources, as well as human and ecosystem health.

T169. Volcanology, Mineralogy, Geochemistry & Petrogenesis of Circum-Pacific Magmatism: A Tribute Session to Gerhard Wörner

Disciplines: Geochemistry; Petrology, Igneous; Volcanology

Advocates: Russell Harmon; Peter W. Lipman; Jon Davidson

This session to honor Prof. Gerhard Wörner, 2013 MGPV Distinguished Career Award recipient, will focus on the physical volcanology, mineralogy, geochemistry, and petrogenetic evolution of magmatism along the circum-Pacific convergent plate boundaries, emphasizing the Andes.

GEOLOGY AND PUBLIC POLICY

T170. 125 Years of Geoscientific Leadership: Success Stories of Using Geoscience to Serve Society

Disciplines: Geology and Public Policy; Environmental Geoscience; Engineering Geology

Advocate: R. Laurence Davis

This session will celebrate 125 years of GSA fulfilling its research and service mission by providing a forum for GSA members to share success stories of how their work serves society and promotes Earth stewardship.

T171. Disposal of Radioactive Waste: Promise, Progress, Pitfalls, and Path Forward

Disciplines: Geology and Public Policy; Environmental Geoscience; Hydrogeology

Advocates: Bret W. Leslie; David Pickett

Geologic disposal of radioactive waste was first endorsed in 1957. This session will address the subsequent progress and potential pitfalls of scientific and societal aspects of radioactive waste disposal and its potential future path.

T172. Diversity: Obstacles, Strategies, and Value of Women in the Geoscience Workforce

Disciplines: Geology and Public Policy; Economic Geology; Geoscience Education

Advocate: Ann Vasko

Diverse heterogeneity of U.S. citizens is our greatest asset. Ignoring talent in our own backyard deprives each of us the opportunity to succeed and negatively impacts our economy and company profits. It is time to ACT.

T173. Scientists in Society: The Role of Multidisciplinary Scientists in a Changing Political World

Disciplines: Geology and Public Policy; Geology and Health; Geoscience Education

Advocate: Kristi Pullen

Political decisions require balancing competing needs. This session will explore the role of science and scientists in shaping political discussions. Specifically, we will explore the value of multidisciplinary training in traversing the science policy gap.

**T174. Societal Demand as a Driver for Geoscientific Research—
What Happens after the Driver Walks Away? Yucca Mountain
Geoscientists Report**

Disciplines: Geology and Public Policy; Geochemistry;
Hydrogeology

Advocates: Claudia M. Newbury; John Stuckless

Investigations begun as part of the former Yucca Mountain program are still contributing to the advancement of geoscience. Regulatory requirements have inspired new and innovative work and development of unique thought processes and approaches, and responded to a societal demand.

**REMOTE SENSING/GEOGRAPHIC INFO
SYSTEM**

**T175. From Desert to Delta: Geologic Research and Applications
in Egypt in the First Decade of the 21st Century**

Disciplines: Remote Sensing/Geographic Info System;
Hydrogeology; Archaeological Geology

Advocates: Barbara J. Tewksbury; Farouk El-Baz;
Elhamy Tarabees

This session will present recent work on the geology and geologic evolution of Egypt and on geoscience research as applied to resource exploration, hazard analysis and mitigation, and other fields, such as archaeology.

VOLCANOLOGY

**T176. Applied Volcanology: The Role of Physical Volcanology
and Volcanic Facies Mapping in Mineral Deposit Studies**

Disciplines: Volcanology; Economic Geology; Precambrian
Geology

Advocates: George J. Hudak; Thomas Monecke

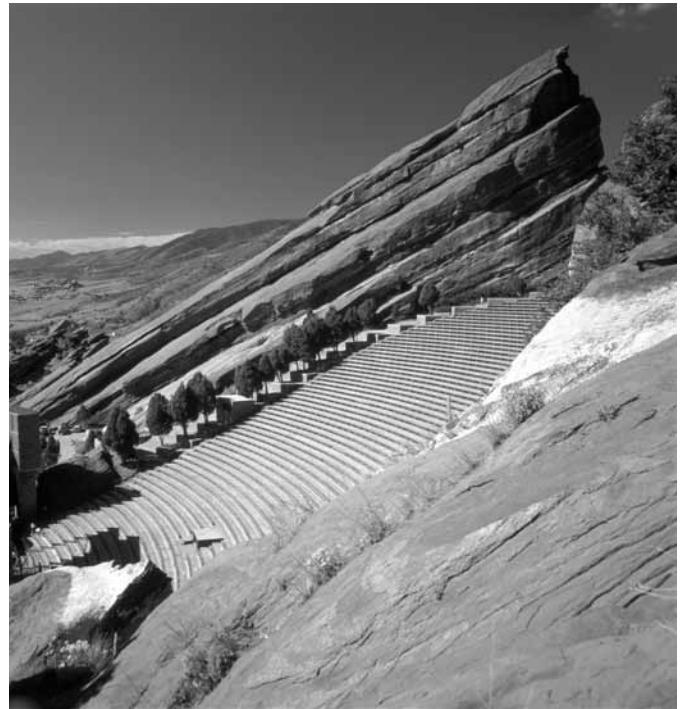
Volcanic rocks host some of the world's most significant ore deposits. This session explores recent advances in understanding volcanic and magmatic controls on the location and formation of modern and ancient ore deposits.

**T177. Volcanism, Tectonics, and Hydrothermal Activity on the
Track of the Yellowstone Hotspot Track**

Disciplines: Volcanology; Geophysics/Tectonophysics/
Seismology; Quaternary Geology

Advocates: Lisa A. Morgan; Kenneth L. Pierce; W.C. Pat Shanks

This session seeks to advance understanding of the multiple processes of volcanic, tectonic, glacial, and hydrothermal processes that interacted to produce the track of the Yellowstone hotspot. Multidisciplinary contributions focused on coupled processes are encouraged.



Red Rocks Amphitheatre. Photo by Ron Ruhoff, Denver Metro Convention & Visitors Bureau.

TECTONICS

**T178. A Review of Old and New Concepts in Laramide Basin
Evolution: A Multidisciplinary Approach**

Disciplines: Tectonics; Stratigraphy; Structural Geology

Advocates: Peter E. Barkmann; J.L. Aschoff; Jeremiah B.
Workman; Marieke Dechesne

This session aims to contrast old and new ideas about Laramide basin evolution. We encourage submissions from the Rockies and beyond, dealing with structural and/or stratigraphic problems in Laramide tectonics.

**T179. Geological and Geophysical Constraints on the Tectonic
Evolution and Resource Potential of Alaska and the Northern
North American Cordillera**

Disciplines: Tectonics; Geophysics/Tectonophysics/Seismology;
Economic Geology

Advocates: James V. Jones; Stephen E. Box; Richard W. Saltus

This session invites integrative, multidisciplinary contributions to understanding the tectonic evolution of the northern North American Cordillera. Studies emphasizing relationships between tectonic processes and energy and mineral resources are encouraged.

T180. Gondwanan Terranes along Laurentian Margins

Disciplines: Tectonics; Geochemistry; Structural Geology

Advocates: David A. Foster; Paul A. Mueller; Craig B. Grimes

This session will focus on new geological, geochemical, and geophysical data, and syntheses of emplacement mechanisms of crust and lithospheric mantle with Gondwanan affinities along the southern, eastern, and western margins of Laurentia.

T181. Modern Techniques, Models, and Interpretations of Ancient Orogens: 125 Years of Progress in Understanding the Grenville and Appalachian Orogens of Eastern North America
Disciplines: Tectonics; Geophysics/Tectonophysics/Seismology; Petrology, Igneous
Advocates: Chris Holm-Denoma; Arthur Merschat

The Grenville and Appalachian orogens are the most profound tectonic elements of eastern North America. We invite contributions that use modern techniques and interpretations to add to a knowledge base spanning more than 125 years.

T182. Paleomagnetism of the Americas and Europe and Their Surroundings: Questions Answered, Questions Remaining, and Questions to Come
Disciplines: Tectonics; Geophysics/Tectonophysics/Seismology; Structural Geology
Advocates: J.W. Geissman; Rob Van der Voo

We seek contributions that bear on the importance of paleomagnetic research in addressing geologic processes and that provide a forum for future challenges and opportunities.

T183. Rates and Thermomechanical Characteristics of Processes Controlling the Rheologic Evolution of Arc Systems
Disciplines: Tectonics; Structural Geology; Geochemistry
Advocates: Stacia Gordon; Robert Miller

We encourage a broad range of presentations that investigate the processes occurring in and adjacent to continental arc systems and within the corresponding subduction zone that control the rheologic evolution of the arc orogenic system.

T184. Recent Advances in Thermochronology
Disciplines: Tectonics; Geochemistry; Geomorphology
Advocates: Rebecca Flowers; James R. Metcalf

The goal of this session is to highlight recent advances in the use and understanding of thermochronology, including advances in methodology, and the application of thermochronology to address geologic and tectonic questions.

T185. Rifting, Drifting, and Accretion of Microcontinental Terranes: A Recipe for Accretionary Orogens
Disciplines: Tectonics; Structural Geology; Geophysics/Tectonophysics/Seismology
Advocates: William A. Thomas; Cees R. van Staal; J. Brendan Murphy

Processes of terrane transfer (rifting, drifting, accretion) are keys to global plate reconstructions, breakup of supercontinents, and opening and closing of oceans. This session will review microcontinental terranes and current research on terrane transfer.

T186. STAMP: Structure, Tectonics, and Metamorphic Petrology
Disciplines: Tectonics; Structural Geology; Petrology, Metamorphic
Advocates: Christian Teyssier; Donna L. Whitney

Structural and metamorphic geology can be combined to solve tectonic problems and understand deformation processes. This session may include discussion of microstructure-metamorphic interactions, thermobarometry, geochronology, deformation mechanisms in nature and experiments, and numerical modeling.

T187. Tectonics and Paleoenvironments of Western Pangaea—New Perspectives on the Greater Ancestral Rocky Mountains
Disciplines: Tectonics; Stratigraphy; Structural Geology
Advocate: Chuck Kluth

The Greater Ancestral Rocky Mountains are an enigmatic, crustal-scale intraplate orogen that formed during the Late Paleozoic assemblage of Pangaea. This session will bring together a diverse, multidisciplinary group to present new data and interpretations.

T188. Tethyan Evolution and Seismotectonics of Southwest Asia: In Honor of the 40 Years of Manuel Berberian's Research Contributions
Disciplines: Tectonics; Geophysics/Tectonophysics/Seismology; Geochemistry
Advocates: Rasoul Sorkhabi; Eric J. Fielding; Mark Allen; Jahandar Ramezani

This interdisciplinary session focuses on the Late Proterozoic–Quaternary geologic evolution of the Iranian-Anatolian plateaus, Zagros-Caucasus-Bitlis orogens, and Arabian Plate, with implications for the active deformation and seismotectonics of the region.

T189. The Basement Complex (or Complex Basement): What Is It? How Is It Formed, Conserved, and Modified? And How Are Mineral Resources and Geologic Hazards Distributed Within It?
Disciplines: Tectonics; Geophysics/Tectonophysics/Seismology; Petrology, Igneous
Advocates: Chris Holm-Denoma; Karen Lund

We seek presentations that explore and explain processes related to the growth (accretion), conservation (non-destructive preservation), and modification (thickening and/or differentiating = “cratonizing”) of juvenile crust to form continental basement and distribute resources and hazards.

T190. The Life and Death of Mobile Belts along the North American Cordillera: Advances in Understanding the Long-Term Construction of Continental Margins (Posters)
Disciplines: Tectonics; Geophysics/Tectonophysics/Seismology; Stratigraphy
Advocates: Emily S. Finzel; Brian A. Hampton; Jeffrey M. Trop

This cross-disciplinary session will explore emerging ideas about tectonic processes that have shaped the Phanerozoic development of the North American Cordillera. Studies that utilize geochronology, geophysics, sedimentology/stratigraphy, and structural geology are encouraged.

T191. The Rio Grande Rift: New Insights on the Evolution of Faulting, Magmatism, Sedimentation, and Landscape

Disciplines: Tectonics; Geophysics/Tectonophysics/Seismology; Volcanology

Advocates: Mark R. Hudson; V.J.S. Grauch

This session solicits contributions from all disciplines that bear on the evolution of structure, magmatism, sedimentation, natural resources, and landscape in this classic continental rift, from inception to its current crustal character and geodetic strains.

T192. Volcanic/Tectonic Processes and Their Interactions on Rocky Planets and Moons

Disciplines: Tectonics; Volcanology; Structural Geology

Advocates: Simon A. Kattenhorn; Danielle Wyrick

We invite abstracts on the mapping or modeling of volcanic and tectonic features on rocky solar system bodies, including terrestrial analogs, emphasizing volcanic/tectonic interaction and resultant structural and geomorphological evolution of rocky planets and moons.

SEDIMENTS, CARBONATES/CLASTIC

T193. Continental Carbonates

Disciplines: Sediments, Carbonates; Limnogeology; Geomicrobiology

Advocates: Elizabeth Gierlowski-Kordesch; David B. Finkelstein

Continental carbonates contribute paleoenvironmental information for reconstructions of paleoclimate as well as landscape drainage patterns. Research on lacustrine and palustrine limestones, microbialites and spring deposits, and evaporites will be highlighted.

T194. Current Understanding of Dolomite, Dolomitization, and Dolomite Problems

Disciplines: Sediments, Carbonates; Mineralogy/Crystallography; Geomicrobiology

Advocate: Huifang Xu

This session will cover compositions and structures of sedimentary dolomite, catalysts in sedimentary dolomite formation, molecular level understanding and laboratory synthesis of low-temperature dolomite and proto-dolomite; roles of microbes in dolomite formation; dolomite and sedimentary environment; and dolomite and hydrocarbon reservoirs mud carbon sequestration.

T195. Advances in Quantitative Sediment Provenance Research: Novel Approaches from Multi-Proxy Provenance Data to Provenance Modeling

Disciplines: Sediments, Clastic; Tectonics; Stratigraphy

Advocates: Joel E. Saylor; David L. Barbeau; Daniel F. Stockli

We seek global examples of multiple, quantitative approaches to sediment provenance or provenance modeling to characterize patterns of exhumation of orogens, identify regions of focused tectonism, delimit sediment dispersal systems, and track sediment routing systems.

T196. Ancient Floodplains and Rivers: Unraveling the Mysteries of Colorado's Conglomerates

Disciplines: Sediments, Clastic; Geomorphology; Stratigraphy

Advocate: Matthew L. Morgan

The origins and ages of many conglomeratic units within Colorado are enigmatic. This session will explore the topic by convening geologists with an emphasis on field-based experience to share observations and insights from their research.

T197. Sevier to Laramide Tectonism along the Western Laurentian Margin: Sedimentologic and Stratigraphic Constraints on Cretaceous-Tertiary Magmatism, Deformation, and Orogenic Exhumation

Disciplines: Sediments, Clastic; Tectonics; Stratigraphy

Advocates: J. Brian Mahoney; Kathleen Surpress; David L. Kimbrough; Catherine I. Smith

This session examines the sedimentary record of the Cretaceous to Tertiary Sevier to Laramide transition along the western Laurentian margin through integrated provenance, sedimentologic, and stratigraphic analyses. Studies that integrate provenance techniques are particularly encouraged.

STRATIGRAPHY

T198. Earth Deep Time Revolution by Global Chronostratigraphic Correlation

Disciplines: Stratigraphy; Paleontology, Biogeography/Biostratigraphy

Advocates: Stanley C. Finney; L.E. Edward; Robert W. Scott

Defining global units and boundaries along with advances in integrated stratigraphic correlation and calibration of numerical ages have revolutionized the ICS International Chronostratigraphic Chart/Geologic Time Scale for deciphering the tempo and mode of Earth's history.

T199. Impact of GSSPs on The Evolution of North American Chronostratigraphy

Disciplines: Stratigraphy; Paleontology, Biogeography/Biostratigraphy

Advocates: Stanley C. Finney; Brian R. Pratt; Richard H. Fluegeman

The International Commission on Stratigraphy is well advanced in establishing a single set of global units defined by GSSPs for the International Chronostratigraphic Chart. What is the impact of its application to North American chronostratigraphy?

T200. Paleozoic Rocks in the Denver Basin

Disciplines: Stratigraphy; Economic Geology; Petroleum/Energy

Advocate: Steven A. Tedesco

Paleozoic strata in the Denver Basin have been receiving a lot of attention as new petroleum productive reservoirs are being found, revising previous stratigraphic concepts.

STRUCTURAL GEOLOGY

T201. Arizona Geology: A Session on All Aspects of Arizona Geology Convened to Commemorate the 125th Anniversary of the Arizona Geological Survey (Posters)

Disciplines: Structural Geology; Stratigraphy; Geomorphology

Advocate: Jon E. Spencer

This session is intended to be a showcase for studies of the diverse and complex geology of Arizona, its long and well-displayed geologic history, its abundant mineral resources, and its geomorphology and geologic hazards.

T202. Critical Taper and Orogenic Flow: Compatible or Incompatible Elements?

Disciplines: Structural Geology; Tectonics; Petrology, Metamorphic

Advocates: Dan Gibson; Felix Gervais

Critical taper and orogenic flow are sometimes cast as being incompatible. Some think they are compatible and inherently coupled elements of orogenic development. This session aims to facilitate meaningful debate on these fundamental orogenic processes.

T203. Evolving Understanding of Extensional Provinces: Advancements and Challenges

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

Advocates: Ibrahim Çemen; Anne E. Egger; G. Randy Keller; Benjamin Surpless

This session will bring together researchers studying various aspects of extensional tectonics and provide a formal discussion on important questions related to our understanding of the processes involved, including active tectonics in extended terrains.

T204. Fluid-Mineral Interaction Mechanisms and Their Effect on Catalyzing Deformation and Metamorphism

Disciplines: Structural Geology; Tectonics; Petrology, Metamorphic

Advocates: David Schneider; Diane Skipton

This session will explore the effect of fluid-mineral interactions on catalyzing deformation and metamorphism from microscale to macroscale, within a range of tectonic environments. A variety of innovative approaches will be highlighted, including field- and laboratory-based procedures and computational modeling.



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T205. From Extension to Rift to Drift: Geological, Geophysical, and Geodynamic Perspectives

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

Advocates: Eunseo Choi; Maria Beatrice Magnani; Nicholas W. Hayman

Extension at rifts, mid-ocean ridges, and plate interiors is accommodated via a range of processes, from diking to detachment faulting. This session aims to bridge geological, geophysical, and modeling approaches to understanding these extensional processes.

T206. Magma Transport, Emplacement, and Accommodation: Morphology, Mechanisms, and Models

Disciplines: Structural Geology; Petrology, Igneous; Geophysics/Tectonophysics/Seismology

Advocates: Penelope Wilson; Eric Horsman; Ken McCaffrey; Nick Schofield

This session covers various aspects of igneous emplacement. Topics may include duration of assembly, petrologic/geochemical processes, space-making mechanisms, seismic imaging, internal structures and fabrics, and the role of crustal structures/tectonic strain in ascent and emplacement.

T207. New Developments in Structural and Tectonic Controls on Ore Deposits

Disciplines: Structural Geology; Economic Geology; Tectonics

Advocates: Yvette D. Kuiper; Shoufa Lin

Ore deposits are controlled by structural and tectonic processes. We invite new contributions to the understanding of local scale structural controls on ore deposit formation and modification to tectonic scale controls on ore deposit genesis.

T208. Orogeny in the U.S. West: Hinterland, Retroarc Fold-Thrust Belt, and Foreland Systems

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

Advocates: Arlo Brandon Weil; Adolph Yonkee

The North American Cordillera is a classic orogenic system that evolved in response to subduction-related processes. This session will bring together new ideas on plate-scale geodynamics to deformation mechanisms that have shaped the hinterland, retroarc fold-thrust belt, and deformed foreland.

T209. Structural Geology and Geomechanics in the Petroleum Industry

Disciplines: Structural Geology; Petroleum/Energy; Tectonics

Advocates: J. Steve Davis; Peter Hennings; Stephen Laubach

This session highlights structural geology and geomechanics research with strong petroleum industry applicability. Topics include regional structural analysis, computational and kinematic deformation modeling, fracture and fault characterization, and interaction of buoyant fluids with geologic structures.

T210. Structure and Evolution of Brittle Faults and Fault Rocks: Physical Properties, Geometry, and Geochemical Changes That Influence Water, Energy, and Mineral Resources

Disciplines: Structural Geology; Hydrogeology; Economic Geology

Advocates: Jonathan Saul Caine; Samuel H. Haines; Kelly K. Bradbury

Faults are heterogeneities that host or influence the location of mineral deposits, trap hydrocarbons, and cause anisotropic groundwater flow, but representing their petrophysical properties remains incomplete. Session highlights include field, laboratory, and numerical modeling research.

T211. The Rock Record of Fault Rheology and Slip Dynamics

Disciplines: Structural Geology; Geophysics/Tectonophysics/Seismology; Neotectonics/Paleoseismology

Advocates: Christie D. Rowe; Darrel S. Cowan; W. Ashley Griffith; Phillip G. Resor

Pseudotachylytes have provided the only fault rock proof of earthquakes, but newly proposed evidence may expand our ability to recognize past fast and dynamic slip. Contributions from field, experiment, and seismology on fault dynamics and the rock record are sought.

T212. The Role of Tectonic Inheritance in Continental Extension

Disciplines: Structural Geology; Tectonics

Advocates: John Singleton; Martin S. Wong; Michael Wells

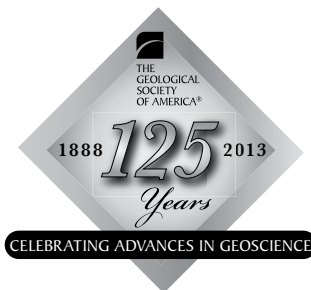
This session will explore tectonic inheritance in continental extensional terranes. Potential topics include the relationship between crustal thickening and extension, extensional reactivation of shear zones, polyphase extension, and the role of preexisting structures in metamorphic core complex development.

T213. Through the Looking Glass: Microstructural Insights into Tectonic Processes

Disciplines: Structural Geology; Tectonics; Petrology, Metamorphic

Advocates: Jamie Levine; Martha Growdon

This session highlights emerging and novel uses of microstructures as fundamental tools for understanding tectonic processes and accentuating field-based, petrologic/graphic, experimental, and geochronological approaches. Contributions emphasizing unique or integrative applications of microstructural analysis are encouraged.



MINERALOGY/CRYSTALLOGRAPHY

T214. Advances in Mineralogy, Crystallography, and Petrology: In Honor of Frank C. Hawthorne, 2013 Roebling Medalist

Disciplines: Mineralogy/Crystallography; Petrology, Igneous
Advocates: Peter C. Burns; Lee A. Groat

In honor of Prof. Frank C. Hawthorne, 2013 Roebling Medalist, this session explores advances in mineralogy, crystallography, and petrology, with a breadth consistent with the sweeping impact of Frank's scholarship.

T215. Frontiers in High-Pressure Research: In Honor of Wendy Li-Wen Mao, 2013 MSA Awardee

Disciplines: Mineralogy/Crystallography; Geophysics/
 Tectonophysics/Seismology; Petrology, Experimental
Advocates: Yingwei Fei; Juhn G. Liou; Maria Baldini

This session focuses on recent technical advances in high-pressure research, including high-pressure techniques, synchrotron radiation-based diffraction, imaging, and spectroscopic methods, micro-/nano-scale analytical techniques, and new findings resulting from these new developments.

T216. Gemological Research in the 21st Century: Characterizing Diamonds and Other Gem Minerals

Disciplines: Mineralogy/Crystallography; Economic Geology;
 Geoscience Information/Communication
Advocates: James E. Shigley; Dona M. Dirlam;
 George R. Rossman; George E. Harlow; William B. Simmons;
 Frank Hawthorne

Gemstones are the most recognized, sought after, and highly valued of all minerals. This session will focus on characterizing the properties of gems, documenting their conditions of formation, and improving the means of their identification.

T217. Using Minerals to Answer Archaeological Questions

Disciplines: Mineralogy/Crystallography; Archaeological
 Geology; History and Philosophy of Geology
Advocate: Jean F. Demouth

This session will be a forum for collaborative projects in both mineralogy and archaeology. Minerals can provide information that may answer questions about material sources, trade routes, technologies, past uses, or the age of some materials.

PETROLOGY, IGNEOUS/METAMORPHIC/
EXPERIMENTAL**T218. Illuminating Felsic Origins: Using Novel Multiple-Method Approaches to Investigate the Birth of Silicic Magmas**

Disciplines: Petrology, Igneous; Volcanology; Mineralogy/
 Crystallography
Advocates: Susanne M. McDowell; Ayla Pamukcu; Tamara L. Carley
 Petrologists have long investigated, and vigorously debated, the mechanisms driving felsic petrogenesis. We will discuss the benefits, challenges, and outcomes of creatively combining multiple analytical and modeling methods to investigate the origins of felsic magmas.

T219. Microanalysis of Trace Elements and Isotopes in Igneous Petrology: Applications to Genesis, Storage, Evolution, Transport, and Eruption of Magma

Disciplines: Petrology, Igneous; Geochemistry; Volcanology
Advocates: Frank C. Ramos; Scott Boroughs
 Recent and continuing technological advances put micro-analysis of trace elements and isotopes at the forefront of petrological investigation. We welcome contributions that spotlight applications of these methods to frontier problems of volcanic and plutonic processes.

T220. Processes and Timescales of Magma Evolution in the Crust: Insights from the Past Fifty Years and Approaches for the Next Fifty Years

Disciplines: Petrology, Igneous; Volcanology; Tectonics
Advocates: Cal Barnes; Wendy A. Bohron; Calvin F. Miller
 This session will elucidate magmatic timescales and processes that produce plutonic and volcanic rocks and highlight new research approaches to promote understanding *P-T-t-X* paths of magmas as they traverse through and stall in the crust.

T221. The Development, Application, and Value of Phase Diagrams for Understanding High-Temperature Crustal and Upper Mantle Rocks

Disciplines: Petrology, Igneous; Petrology, Metamorphic;
 Petrology, Experimental
Advocates: Callum J. Hetherington; Philippe Goncalves
 This session celebrates the ubiquitous use and application of phase diagrams as tools for teaching, visualizing, understanding, and modeling geologic processes in the crust and upper mantle.

T222. What Can We Learn About Plutons from Volcanic Rocks and What Can We Learn About Volcanoes from Plutonic Rocks?

Disciplines: Petrology, Igneous; Volcanology; Geochemistry
Advocates: Drew S. Coleman; Ryan D. Mills; Allen F. Glazner
 Recognition that many plutons were accumulated incrementally calls into question proposed links between volcanic and plutonic rocks. This session explores the role that shallow magma chambers play in generating eruptible magma.



T223. Revealing Thermal Histories Using Chronological and Mineralogical Techniques

Disciplines: Petrology, Metamorphic; Petrology, Igneous; Tectonics

Advocates: Jeffrey Oalmann; Spencer Seman; Josh Feldman

Many different chronological and mineralogical techniques have been applied and developed over the last 50 years to decipher thermal histories of regions. We invite contributions that apply or improve geochemical techniques to determine thermal histories.

**PALEOCLIMATOLOGY/
PALEOCEANOGRAPHY**

T225. Climate of the Late Paleozoic—Earth’s Last Icehouse and Icehouse Collapse

Disciplines: Paleoclimatology/Paleoceanography; Stratigraphy; Paleontology, Diversity, Extinction, Origination

Advocates: Gerilyn S. Soreghan; William A. DiMichele

The late Paleozoic archives Earth’s last icehouse collapse on a fully vegetated planet, accompanied by a large CO₂ increase. We seek contributions on records of both data and modeling of this major climate transition.

T226. Geologic Process Rates—Past, Present and Future

Disciplines: Paleoclimatology/Paleoceanography; Geomorphology; Environmental Geoscience

Advocates: William W. Hay; Bruce Wilkinson

Recent advances in dating methods make it possible to better determine rates of geologic processes in the past. Humans are accelerating the rates of geologic change with uncertain consequences.

T227. Into the Frying PAN: The Early Triassic Hothouse of Pangea and Panthalassa

Disciplines: Paleoclimatology/Paleoceanography; Paleontology, Diversity, Extinction, Origination; Paleontology, Biogeography/Biostratigraphy

Advocates: Thomas J. Algeo; Arne M.E. Winguth; David J. Bottjer

This session will feature new research related to the extreme climate conditions of the Early Triassic, representing the aftermath of the largest mass extinction in Earth’s history.

T228. Paleoclimate Proxies and Evolving Human Landscapes

Disciplines: Paleoclimatology/Paleoceanography; Archaeological Geology; Quaternary Geology

Advocates: Justin P. Dodd; Katherine A. Adelsberger

Environmental proxies provide insights into the context of human landscapes and their changes over time. We welcome submissions focusing on the application of Quaternary paleo-environmental data to geoarchaeological settings, including proxy reconstructions.

T229. Past Climates of the Middle East from Proxy Records; Insights on Water Resources and Impacts on the People of the Region

Disciplines: Paleoclimatology/Paleoceanography; Quaternary Geology; Hydrogeology

Advocates: Jason A. Rech; Mustafa Al Kuisi

Paleoclimatic proxy records from throughout the Middle East provide insights into how climate operates and changes at diverse temporal scales and how potential future changes in climate may impact water resources and societies.

T230. Quantitative Reconstructions of the Large-Scale Cenozoic Terrestrial Climate Change

Disciplines: Paleoclimatology/Paleoceanography; Paleontology, Paleocology/Taphonomy; Paleontology, Biogeography/Biostratigraphy

Advocates: Yusheng Liu; Torsten Utescher

The session will address the large-scale Cenozoic terrestrial climate change by integrating evidence from various paleo-proxies and modeling experiments.

T231. Quaternary Vegetation-Fire-Climate Interactions

Disciplines: Paleoclimatology/Paleoceanography; Quaternary Geology; Environmental Geoscience

Advocates: Christy Briles; Susann Stolze

This session addresses the causes and timing of changes in the natural environment, and specifically the use of high-resolution multi-proxy paleoenvironmental records to understand complex interactions among vegetation, fire, and climate during the Quaternary.

PALEONTOLOGY

T232. Using the Past to Look to the Future: Reconstructing Terrestrial Paleoenvironments and Paleoecosystems of Past Warm Worlds

Disciplines: Paleoclimatology/Paleoceanography; Paleontology, Paleocology/Taphonomy; Stratigraphy

Advocates: Nathan D. Sheldon; Selena Y. Smith

This session will bring together case studies using paleoclimate, proxy, and paleobiological data to investigate ancient warm worlds as models for understanding the potential biological and environmental impacts of a future warm world.

T233. Celebrating Advances in Conodont Studies—134 Years of North American Conodonts

Disciplines: Paleontology, Biogeography/Biostratigraphy; Paleontology, Phylogenetic/Morphological Patterns

Advocates: D. Jeffrey Over; Stephen A. Leslie; John E. Repetski

This session celebrates 134 years since the publication of Hinde’s landmark study on Ordovician and Devonian conodonts from eastern North America and welcomes contributions on all things conodont-related, be it historical, modern, or futuristic.

T234. Cyberinfrastructure for Paleogeographic Synthesis

Disciplines: Paleontology, Biogeography/Biostratigraphy; Paleoclimatology/Paleoceanography; Tectonics
Advocates: Scott Lidgard; Bradley Sageman; David B. Rowley; Shan'an E. Peters

This session will bring together individuals from diverse geoscience backgrounds in the interest of developing Web-based resources that integrate geological, paleobiologic, geochemical, and stratigraphic data with paleogeographic, paleoclimatic, and plate tectonic reconstructions.

T235. The Importance of Museum Collections for Paleontologic Research

Disciplines: Paleontology, Biogeography/Biostratigraphy; Stratigraphy; Geoscience Education
Advocates: Mena Schemm-Gregory; Howard R. Feldman; Robert B. Blodgett

Paleontological museum collections are often the only source of information about temporary outcrops or rare fossil material. The actual state of specific collections or infrastructure of their accessibility should be introduced.

T236. Biological and Environmental Feedbacks in the Colonization of the Water Column

Disciplines: Paleontology, Diversity, Extinction, Origination; Paleontology, Paleoecology/Taphonomy; Paleoclimatology/Paleoceanography
Advocates: Mark Williams; Thijs Vandenbroucke; Bradley D. Cramer

This session will explore linkages between zooplankton evolution, phytoplankton productivity, and the development of higher taxa during the Paleozoic, their relationship with climate and oceanographic change, and the availability of seabed and plankton ecospace.

T237. Coevolution of the Earth and Life: The Role of the Physical Environment in Species Evolution

Disciplines: Paleontology, Diversity, Extinction, Origination; Paleontology, Paleoecology/Taphonomy; Paleontology, Biogeography/Biostratigraphy
Advocates: Corinne E. Myers; Erin E. Saupe

This session invites research on the impact of a dynamic planet on species evolution. Contributions considering how the fossil record can inform modern predictions of species' responses to future environmental changes are encouraged.

T238. New Insights into Triassic-Jurassic Transition Events and End-Triassic Mass Extinction

Disciplines: Paleontology, Diversity, Extinction, Origination; Paleoclimatology/Paleoceanography; Volcanology
Advocates: Rowan C. Martindale; Morgan F. Schaller; Jessica H. Whiteside

Interdisciplinary studies allow the timing and synchronicity of Triassic-Jurassic transition events to be constrained to near-millennial timescales. Research in paleontology, sedimentology, geochemistry, volcanology, radioisometric dating, and C-cycle modeling, and comparisons with similar events, are encouraged.

T239. Recent Advances in the Nature of the Mesozoic Marine Revolution

Disciplines: Paleontology, Diversity, Extinction, Origination; Paleontology, Paleoecology/Taphonomy; Paleontology, Phylogenetic/Morphological Patterns
Advocates: Lydia S. Tackett; Nicole Bonuso

This session will address advances in our understanding of the nature of the Mesozoic Marine Revolution. The MMR encompasses global-scale trends in diversity, paleoecology, and functional morphology across many phyla, as well as important transitions in carbonate geochemistry and sedimentology.

T240. Advances in the Application of Biogeochemical Datasets in Paleoenvironmental and Paleoecological Studies

Disciplines: Paleontology, Paleoecology/Taphonomy; Geochemistry, Organic; Paleoclimatology/Paleoceanography
Advocates: Jordan R. Noret; John F. Graf

This session will emphasize new and refined methods for collecting, screening, and modeling biogeochemical data (e.g., light stable isotope data) to be used in paleoenvironmental and paleoecological studies.

T241. Ancient Polar Ecosystems and Climate History in Deep Time

Disciplines: Paleontology, Paleoecology/Taphonomy; Stratigraphy; Geochemistry
Advocates: Anthony R. Fiorillo; Paul J. McCarthy; Edith L. Taylor

Understanding climate change is relevant because the societal impacts of global warming are considerable. For deep geologic-time studies, multiple proxies are used to reconstruct ancient climates. This session will provide an empirical deep-time perspective for modeling polar ecosystems and climates.



View from above tree-line of Rocky Mountain National Park, Colorado, USA. Photo by keagiles.

T242. Conservation Paleobiology—The Microfossil Record

Disciplines: Paleontology, Paleoecology/Taphonomy; Paleoclimatology/Paleoceanography; Environmental Geoscience
Advocates: Susan T. Goldstein; Jere H. Lipp

This session highlights applications of microfossils in the emerging field of conservation paleobiology, particularly regarding environmental impacts, altered biodiversity and biogeographic patterns, invasive species, climate change, and biogeochemical changes, such as anoxia and ocean acidification.

T243. Konservat-Lagerstätten: Morphology, Ecology, and Taphonomy of Exceptionally Preserved Fossils

Disciplines: Paleontology, Paleoecology/Taphonomy; Paleontology, Phylogenetic/Morphological Patterns; Paleontology, Diversity, Extinction, Origination
Advocates: Maria E. McNamara; Xiaoya Ma

Konservat-Lagerstätten provide crucial insights into the evolution of life on Earth. This session highlights recent developments in the study of exceptionally preserved fossils, including their morphology, ecology, taphonomy (both fossil-based and experimental approaches), and phylogeny.

T244. Paleoclimate and Biotic Change in Africa, Mesozoic to the Present

Disciplines: Paleontology, Paleoecology/Taphonomy; Paleoclimatology/Paleoceanography; Paleontology, Biogeography/Biostratigraphy
Advocates: Ellen D. Currano; Bonnie F. Jacobs

This topical session will focus on new work documenting the evolution of African biotas, their significance for understanding tropical and global paleoclimate, and how these are relevant to the modern world.

T245. The Arthropoda: Paleoecology, Diversity, Taphonomy, and Phylogeny

Disciplines: Paleontology, Paleoecology/Taphonomy; Paleontology, Diversity, Extinction, Origination; Paleontology, Phylogenetic/Morphological Patterns
Advocates: Adiël A. Klompmaker; Rodney M. Feldmann; Carrie E. Schweitzer

Today, arthropods are the most diverse animal group. On the order of tens of thousands of species are known from the fossil record. This session presents research on broad, cutting-edge topics dealing with fossil arthropods.

T246. Topics in Paleoecology: Predation/Biotic Interactions, Fidelity/Conservation Paleobiology, and Community Ecology/Whole Organism Paleoecology

Disciplines: Paleontology, Paleoecology/Taphonomy; Paleontology, Diversity, Extinction, Origination; Paleontology, Phylogenetic/Morphological Patterns
Advocates: Carrie L. Tyler; Amelinda E. Webb; Troy A. Dexter; Mary Elizabeth Kosloski; Ben M.J. Collins

This session invites studies highlighting the diversity of paleoecology, a field at the intersection of biology and geology. Presentations will be organized within a framework of biotic interactions, community ecology, fidelity, and conservation paleobiology in both modern and ancient systems.

T247. Tracking Life History: New Developments in Ichnological Research

Disciplines: Paleontology, Paleoecology/Taphonomy; Paleontology, Biogeography/Biostratigraphy; Stratigraphy
Advocates: Christopher D. Aucoin; Patrick Ryan Getty; Jayme Csonka

We seek contributions regarding all aspects of vertebrate and invertebrate ichnology, from historical perspectives to site reports and taxonomic treatments. Presentations involving new methodologies and techniques, including experimental setups and computer simulations, are strongly encouraged.

T248. Unlocking Lilliput: New Approaches to Microscopy in Paleontology

Disciplines: Paleontology, Paleoecology/Taphonomy; Paleontology, Diversity, Extinction, Origination; Paleontology, Biogeography/Biostratigraphy
Advocates: Thomas Hegna; K. Leo Pullin

The microscopy revolution has brought new methods, light and electron microscopies, and micro-computed tomography into paleontology to couple with traditional techniques. This session aims to showcase methods that bring unique perspectives to old questions.

T249. Beyond Diversity Curves: Exploring Research Opportunities within the Paleobiology Database

Disciplines: Paleontology, Phylogenetic/Morphological Patterns; Paleontology, Paleoecology/Taphonomy; Paleontology, Biogeography/Biostratigraphy
Advocates: Matthew E. Clapham; Carrie E. Schweitzer

This session highlights the breadth of research performed with the Paleobiology Database. Topics include evolutionary ecology, phylogenetics, systematics, taphonomy, biodiversity and extinction, or biogeography. We particularly encourage studies with a strong specimen- or field-based component.

PETROLEUM/ENERGY

T250. A Comprehensive Look at Hydraulic Fracturing for Hydrocarbon Recovery and Other Purposes

Disciplines: Petroleum/Energy; Environmental Geoscience; Hydrogeology

Advocates: Neil Coleman; Gerry V. Winter

This session will evaluate the geotechnical, geophysical, and environmental aspects of hydraulic fracturing for hydrocarbon resource recovery in gas and oil shales and coal beds and other applications, such as contaminant remediation.

T251. Advances in Describing the Critical Geologic Components of Effective Oil and Gas Reservoirs

Disciplines: Petroleum/Energy; Sediments, Clastic; Structural Geology

Advocate: Krystal M. Pearson

Recent advances in the geologic understanding of oil and gas reservoirs permit greater recovery rates. This session explores new work in defining geologic controls (e.g., sedimentary, structural, diagenetic, burial history) of effective oil and gas reservoirs.

T252. Cutting Edge Use of GPS/GIS Technology in Geography and Geosciences

Disciplines: Petroleum/Energy; Remote Sensing/Geographic Info System; Geoinformatics

Advocate: Ashok Wadwani

This sessions involves the cutting edge use of GPS/GIS technology in geography and geosciences.

T253. Multidisciplinary Characterization of “Unconventional” Hydrocarbon Resources: Nano- to Basin-Scale Investigations on Resource Occurrence and Potential Environmental Impacts
Disciplines: Petroleum/Energy; Stratigraphy; Mineralogy/ Crystallography

Advocates: Mark P.S. Krekeler; Brian Currie

This session is dedicated to aspects of unconventional hydrocarbon resources, including reservoir properties, organic geochemistry, mineralogy, petrophysics, sedimentological and sequence stratigraphic controls on hydrocarbon occurrence, controls on the basin-scale distribution of hydrocarbons, and environmental properties.

T254. New Advances in Pore System Characterization Cross Geologic Boundaries

Disciplines: Petroleum/Energy; Sediments, Clastic; Sediments, Carbonates

Advocates: Anita Csoma; Alice Stagner

Recent advances in shale characterization have spurred the application of new imaging and modeling techniques to non-shale reservoirs. This session highlights techniques and concepts of pore system characterization and modeling for all 21st-century reservoirs.

T255. Produced Waters: Characterization and Impacts of Subsurface Brine and Formation Water Associated with Hydrocarbon Production

Disciplines: Petroleum/Energy; Hydrogeology; Geochemistry

Advocates: Madalyn S. Blondes; Mark A. Engle

This session explores research advances in waters associated with hydrocarbon production, including hydraulic fracturing and CO₂ storage. Topics include novel geochemical modeling methods, tracers for fingerprinting brines, induced seismicity, and environmental impacts of use/disposal.



Moraine Park, Rocky Mountain National Park, Colorado, USA. Photo taken by keagiles in June 2008, before the devastating 2012 Fern Lake Fire swept across this landscape.

PRECAMBRIAN GEOLOGY

T256. Proterozoic Meets Archean: Amalgamation of Laurentia

Disciplines: Precambrian Geology; Tectonics/Tectonophysics; Geochemistry

Advocates: Paul A. Mueller; M.E. Bickford; Daniel K. Holm; David Corrigan

How do differences in lithospheric structure (e.g., well keels typically underlie Archean cratons but not Proterozoic blocks) relate to the structural, magmatic, metallogenic, etc., development of the Proterozoic-Archean boundary zones that characterize Laurentian North America?

T257. Regional to Global Perspectives on the Formation, Assembly, and Tectonic Evolution of Western North America from the Neoproterozoic through the Mesoproterozoic

Disciplines: Precambrian Geology; Tectonics; Geochemistry
Advocates: Christopher G. Daniel; Christopher L. Andronicos; James V. Jones; Karl E. Karlstrom; Colin A. Shaw; Jeffrey D. Vervoort; Michael L. Williams

We seek contributions from a broad range of disciplines that provide regional and global perspectives into the formation, assembly, paleogeography, and tectonic evolution of Laurentia from the Neoproterozoic through the Mesoproterozoic.

T258. The Pulse of the Earth: Episodic and Periodic Events on Timescales of ≥ 10 Million Years

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

Advocates: Kent Condie; Michael Brown; Stephen R. Meyers

This session will focus on our understanding of Earth events on timescales of ≥ 10 million years, including, but not limited to, core, mantle, crust, hydrosphere, cryosphere, biosphere, and atmosphere; impact events, orogenic events, LIPs, and supercontinent cycles.

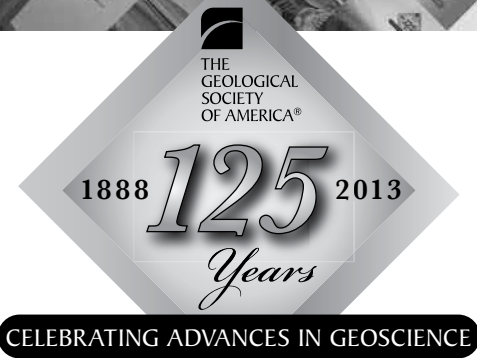


View from Trail Ridge Road, Rocky Mountain National Park, Colorado, USA. Photo by keagiles.

Seminar: How to Publish Your Paper

Debuting at this year's Annual Meeting in Denver: Learn how best to prepare scholarly papers for publication in this workshop aimed at recent Ph.D. and graduate students.

GSA science editors will lead this seminar on the nuts and bolts of preparing a successful geoscience paper, including writing a clear abstract, presenting scholarly research in a scientifically sound and original way, and navigating the review and revision process. More information will be included in upcoming issues of GSA Connection and in the June *GSA Today*.



DISCIPLINE CATEGORIES

Can't find a topical session that fits your abstract? No problem! In addition to topical sessions, we offer the following discipline categories. Discipline sessions are equally vital to our technical program and are an essential addition to the fulfillment of the overall meeting. Encourage your friends to submit a discipline abstract too!

REVIEW GROUP	DISCIPLINE	CONTACT(S)
GSA Archaeological Geology Division	archaeological geology	Katherine A. Adelsberger, kadelsbe@knox.edu; Loren Davis, loren.davis@oregonstate.edu
Association of Earth Science Editors	geoscience information/ communication	Monica Easton, monica.easton@ontario.ca
GSA Coal Geology Division	coal geology	Mark A. Engle, mercurous@gmail.com; Jennifer O'Keefe, j.okeefe@moreheadstate.edu
GSA Environmental and Engineering Geology Division	engineering geology	Dennis Staley, dstaley@usgs.gov; Bill Burns, bill.burns@dogami.state.or.us
Environmental Geoscience	environmental geoscience	Robin John McDowell, rjmcd@uga.edu; Michael Young, michael.young@beg.utexas.edu
GSA Geobiology & Geomicrobiology Division	geomicrobiology	Jocelyn Sessa, sessaj@si.edu
Geochemical Society	geochemistry; geochemistry, other	Frank A. Corsetti, fcorsetti@usc.edu
GSA Geoinformatics Division	geoinformatics	Jeff Vervoort, vervoort@wsu.edu; Bill Hart, hartwk@muohio.edu
GSA Geology and Health Division	geology & health	Kerstin Lehnert, lehnert@ldeo.columbia.edu; Saugata Datta, sdatta@ksu.edu
GSA Geology and Society Division	geoscience and public policy	D. Craig Cooper, craig.cooper@inl.gov; R. Laurence Davis, rldavis@newhaven.edu
GSA Geophysics Division	geophysics/tectonophysics/ seismology	Audrey D. Huerta, ahuerta@geosc.psu.edu; Samantha E. Hansen, shansen@geo.ua.edu
GSA Geoscience Education Division	geoscience education	Don Duggan-Haas, dugganhaas@gmail.com; Elizabeth Heise, eheise@uclalumni.net; Julie C. Libarkin, libarkin@msu.edu
Geoscience Information Society	geoscience information/ communication	Hannah Winkler, hannah.winkler@stanford.edu
GSA History and Philosophy of Geology Division	history of geology	James C. Dawson, dawsonjc@plattsburgh.edu; Renee M. Clary, rclary@geosci.msstate.edu
GSA Hydrogeology Division	hydrogeology	Eliot Atekwana, eliot.atekwana@okstate.edu; Bill Sanford, bills@cnr.colostate.edu
GSA Limnogeology Division	limnogeology	Dan Deocampo, deocampo@gsu.edu
Marine/Coastal Geology	marine/coastal science	Mike Lewis, michael.lewis@nrcan-rcan.gc.ca
Mineralogical Society of America	mineralogy/crystallography; petrology, experimental; petrology, igneous; petrology, metamorphic; volcanology	James S. Beard, jim.beard@vmnh.virginia.gov; Philip Brown, pbrown@geology.wisc.edu
GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division	mineralogy/crystallography; geochemistry; petrology, volcanology	Eric H. Christiansen, eric_christiansen@byu.edu; Diane R. Smith, dsmith@trinity.edu
National Association of Geoscience Teachers	geoscience education	Aida Awad, aawad@maine207.org

DISCIPLINE CATEGORIES (*continued*)

Paleoceanography and Paleoclimatology	paleoclimatology/ paleoceanography	Kristen St. John, stjohke@jmu.edu
Paleontological Society	paleontology, biogeography/ biostratigraphy; paleontology, diversity, extinction, origination; paleontology, paleoecology/taphonomy; paleontology, phylogenetic/ morphological patterns	Seth Finnegan, seth.finnegan@gmail.com; Phoebe Cohen, phoebe.a.cohen@williams.edu; Thomas D. Olszewski, tomo@geo.tamu.edu
Petroleum/Energy	petroleum	Ann Vasko, agivan@ireservoir.com
GSA Planetary Geology Division	planetary geology; remote sensing/geographic information systems	Robert C. Anderson, robert.c.anderson@jpl.nasa.gov; Debra Buczkowski, debra.buczkowski@jhuapl.edu; Devon M. Burr, dburr1@utk.edu
Precambrian Geology	Precambrian geology	Carol D. Frost, frost@uwyo.edu
GSA Quaternary Geology and Geomorphology Division	geomorphology; Quaternary geology	Jim O'Connor, oconnor@usgs.gov; Alan R. Nelson, anelson@usgs.gov
GSA Sedimentary Geology Division	sediments, carbonates; sediments, clastic; stratigraphy	Lauren Birgenheier, lbirgenheier@egi.utah.edu; Greg Ludvigson, gludvigson@kgs.ku.edu
SEPM (Society for Sedimentary Geology)	sediments, carbonates	Neil Tabor, ntabor@mail.smu.edu
Society of Economic Geologists	economic geology	Nigel M. Kelly, nkelly@mines.edu
GSA Structural Geology and Tectonics Division	neotectonics/paleoseismology; structural geology; tectonics	Christine S. Siddoway, csiddoway@coloradocollege.edu; Dan Gibson, hdgibson@sfu.ca

GSA's Associated Societies Program

GSA has a long tradition of collaborating with partners in pursuit of mutual goals to advance the geosciences, enhance the professional growth of members, and promote the geosciences in the service of humanity. As the Society looks to the future, it aims to build strong, meaningful partnerships with other societies and organizations across the country and around the world in service to members and the larger geoscience community. National and international societies with consistent aims and missions of advancing the geosciences and/or science in general are invited to affiliate with GSA as Associated Societies. For more information and a full list of GSA's 63 Associated Societies, go to www.geosociety.org/divisions/.



GEOLOGIC PAST

1963 GSA Annual Meeting Science Highlights, Part 1

The theme of GSA's 125th anniversary meeting is "Celebrating Advances in Geoscience: Our science, our societal impact, and our unique thought processes," with a focus on how far GSA and geoscience have come as a result of scientific and technological advances in the past 50 years.

Over the course of the last 50 years, much has changed in geoscience, not the least being the change in attitude toward the idea of continental drift from "an outrageous hypothesis" (Wise, 1963, p. 357) to the widely accepted theory of plate tectonics.

GSA met for its 75th Annual Meeting in New York on 17–20 November 1963. More than 90 papers were presented there. A scan of the abstracts with the view to advancements in geoscience brings up many highlights, but one that stands out the most is the presentation by Bruce C. Heezen and Marie Tharp: "Oceanic Ridges, Transcurrent Faults, and Continental Displacements," which is reproduced below:

The Mid-Oceanic Ridge, a tectonic belt nearly 40,000 miles long and 200–1500 miles wide that girdles the earth, has been offset in numerous places by transcurrent faults in the Atlantic, Indian, and Pacific oceans. Although the axis of the ridge, the site of a shallow-focus earthquake belt, is now being deformed, the fracture zones are aseismic except in the crest zone of the Mid-Oceanic Ridge. The flanks of the Mid-Oceanic Ridge are aseismic and presumably of considerable age.

Recent investigations in the Indian Ocean reveal several north-south aseismic ridges and east-west aseismic fracture zones which together with the forked Mid-Oceanic Ridge produce a tectonic pattern much more complex than that of the other oceans.

The location and origin of the Mid-Oceanic Ridge, of oceanic rises, aseismic ridges, and transcurrent fault systems must be accounted for in any hypothesis of continental displacement despite unique or exotic assumptions as to strength, viscosity, or composition of the oceanic crust and mantle. (p. 78)

The team of Heezen (1924–1977) and Tharp (1920–2006) worked together from the mid-1940s to 1977. According to Cathy Barton, who wrote a biography of Tharp in 2002, the two "began mapping the sea floor to improve understanding of ocean-basin geology and to connect the oceans to the continents theoretically" (p. 215). During this process, writes Barton, Tharp "made an important discovery: a rift on the Mid-Atlantic Ridge." It was Tharp's interpretation of Heezen's sea-floor data, says Barton, that "contributed to the reintroduction of continental drift theory and the 1960s geological revolution" (p. 215).

Tharp is celebrated in the 2012 book *Soundings: The Remarkable Woman Who Mapped the Ocean Floor*, by Hali Felt, as well

as numerous articles, including a 7 Oct. 2011 "History of Geology" blog post, "Marie Tharp: The map that changed the world," by David Bressan. The 1977 *World Ocean Floor Map* created by Heezen and Tharp is highlighted in a 24 Dec. 2010 "Georneys" blog post, "A famous ocean floor map," by Evelyn Mervine, who writes that "prior to the pioneering work of Heezen and Tharp, almost nothing was known about the topography of the seafloor."

That fact is acknowledged in a 2008 GSA Joint Annual Meeting abstract by Gary North: "Marie Tharp: The lady who showed us the ocean floors." North writes that "Bruce [Heezen] sailed the oceans collecting the data and oversaw the projects, but the person who turned the Precision Depth Recordings and other geoscience data into the two-dimensional views of the bottoms was Marie." North, the curator of Tharp's cartographic materials in the Library of Congress, continues,

Marie's discovery of the trench in the middle of the Mid-Atlantic Ridge and her linkage of the major crustal plates for 40,000 miles around the Earth, showed us, and thus confirmed, the concept of plate tectonics and crustal movement. For the "non-drifters" of the time, which included their boss Dr. Maurice Ewing, this was a somewhat revolutionary concept which eventually erupted in conflicts, suspensions, and academic rivalry.



Marie Tharp and Bruce Heezen contemplating their seafloor map, ca. 1970s. Image courtesy Lamont-Doherty Earth Observatory.

Later in life, however, Tharp received many honors, including Columbia University's first Heritage Award, the National Geographic Society's Hubbard Medal, and the Woods Hole Oceanographic Institute Women Pioneers in Oceanography Award (North, 2008). In 1977, according to a *New York Times* obituary, Tharp was "honored by the Library of Congress as part of the 100th anniversary of its geography and map division." The Earth Institute at Columbia's Lamont-Doherty Earth Observatory established the Marie Tharp Fellowships in the Earth, Environmental, and Ocean Sciences to encourage women to study geoscience there.

In her autobiographical notes related to the acceptance of the Woods Hole award, Tharp writes,

Not too many people can say this about their lives: The whole world was spread out before me (or at least, the 70 percent of it covered by oceans). I had a blank canvas to fill with extraordinary possibilities, a fascinating jigsaw puzzle to piece together: mapping the world's vast hidden seafloor. It was a once-in-a-lifetime—a once-in-the-history-of-the-world—opportunity for anyone, but especially for a woman in the 1940s. The nature of the times, the state of the science, and events large and small, logical and illogical, combined to make it all happen. (Tharp, 2006)

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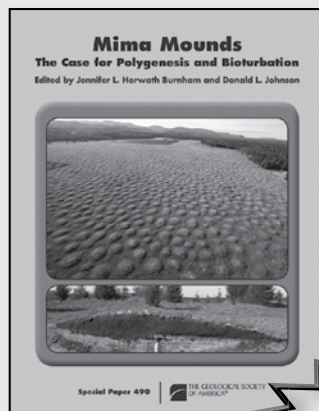


Special Paper 490

Mima Mounds

The Case for Polygenesis and Bioturbation

Edited by Jennifer L. Horwath Burnham and Donald L. Johnson



This volume grew out of a symposium titled "The origin of Mima mounds and similar micro-relief features: Multidisciplinary perspectives," and a similarly themed field trip, both held at the 2008 GSA Annual Meeting. The editors of this volume firmly believe that Mima (pimple) mounds, with a contentious explanatory history that has covered nearly two centuries, deserve a closer look. The clarifying introduction, six chapters, and extensive appendices (including a never before published paper by Roald H. Fryxell) are sure to both resolve questions and inspire debate.

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The Gentle Art of Scientific Trespassing

Walter Alvarez
Department of Geology and Geophysics
University of California
Berkeley, CA 94720

ABSTRACT
Research on impacts and mass extinctions has been interdisciplinary to the extreme. As the field has developed, the scientists involved have learned a number of ways of bridging the barriers that normally separate specialties. The most difficult problems involve different taxonomic or primary and secondary evidence, different cultures or different values, perspectives of a discovery or pecking order of actions, judging the quality of scientific work, and the issues of targets and technical barriers. Using interdisciplinary science involves learning the language of different fields, and when this is done, most of the other barriers melt away. Perhaps the interdisciplinary style that is growing up in this field may eventually be as important as the things we are learning about impacts and mass extinctions.

Author's Note: In 1988, I wrote this book, describing a program of interdisciplinary research at the University of California, Berkeley, and asked you to read it in the hope that geologists would be encouraged to bridge the barriers that normally separate specialties. I am pleased to see that this book has been read by so many geologists. The first book to be read was the book on the impact hypothesis, which was published in the Proceedings of the 1988 Geological Society of America meeting in Denver. I am pleased to see that the book is being read by so many geologists. I am pleased to see that the book is being read by so many geologists. I am pleased to see that the book is being read by so many geologists.

we were already doing interdisciplinary research at Berkeley. In the September, as a team ranging from paleontologists to geologists, we were invited to the Rocky Mountain-South Central Section Meeting, p. 35. I am pleased to see that the book is being read by so many geologists. I am pleased to see that the book is being read by so many geologists. I am pleased to see that the book is being read by so many geologists.

INTRODUCTION
There seems to be a close association between interdisciplinary science and interdisciplinary development in geology, although it is not clear which is the cause and which is the effect. You might disagree, but I think I can give evidence in 20th century geology. The first book to be read was the book on the impact hypothesis, which was published in the Proceedings of the 1988 Geological Society of America meeting in Denver. I am pleased to see that the book is being read by so many geologists. I am pleased to see that the book is being read by so many geologists.

- 1991:** "The gentle art of scientific trespassing," by GSA Senior Fellow Walter Alvarez (February).
- 1992:** "Encounters with the land," by GSA Fellow Lauret E. Savoy (October).
- 1993:** "It's only topography" (parts 1 and 2) by GSA Senior Fellow Ken C. MacDonald & colleagues (January and February).
- 1994:** "On the efficacy of humans as geomorphic agents," by GSA Senior Fellow Roger LeB. Hooke (September).
- 1995:** "Farthest north: Ocean drilling in the Arctic gateway region," by Leg 151 Co-chief Scientists Annik Myhre and GSA Senior Fellow Jörn Thiede along with a large group of staff scientists (February).
- 1996:** "Development of geographic information systems-oriented databases for integrated geological and geophysical applications," by GSA Fellow J. Douglas Walker & colleagues (March).
- 1997:** "Evidence for life in a martian meteorite?," by GSA Senior Fellow Harry Y. McSween Jr. (July).
- 1998:** "Lithoprobe leads to new perspectives on continental evolution," by GSA Fellow Ron M. Clowes & colleagues (October).

Between 1991 and 2012, *GSA Today* published 232 science articles. The list of authors includes more than 200 GSA Fellows—recipients of GSA's highest honors or colleagues who have been nominated and elected to fellowship by their peers.

The first *GSA Today* science article (Jan. 1991, v. 1, no. 1, p. 1–4) was by Donald L. Turcotte (now a GSA Senior Fellow) on "Fractals in geology: What are they and what are they good for?" The last science article of the 1990s (Dec. 1999, v. 9, no. 12, p. 1–6) was written by GSA Senior Fellow Robert S. Young and colleagues about "Hurricanes Dennis and Floyd: Coastal effects and policy implications."

The twenty-first century opened with an article on the 1999 Izmit, Turkey, earthquake by Robert Reilinger and colleagues (v. 10, no. 1, p. 1–6); the last article of 2010 was "Geoinformatics: Transforming data to knowledge for geosciences," by GSA Senior Fellow A. Krishna Sinha.

These examples reveal a substantial variety in terms of the scope of article topics, showing that geoscience is a dynamic, multidisciplinary field spanning everything from mathematics to earthquakes to weather to data mining and beyond. Each year has its own highlights:





2008: “Are we now living in the Anthropocene?,” by Jan Zalasiewicz & colleagues (February).

2009: “Geobiology: Evidence for early life on Earth and the search for life on other planets,” by Sherry L. Cady & GSA Fellow Nora Noffke (November).

2010: “The digital revolution in geologic mapping,” by Steven J. Whitmeyer & colleagues (April/May).

2011: “The big picture: A lithospheric cross section of the North American continent,” by Philip T.C. Hammer & colleagues (with a large plate insert)(June).

2012: “Land transformation by humans: A review,” by GSA Senior Fellow Roger LeB. Hooke & José F. Martín-Duque (November).

1999: “Floods and sandbars in the Grand Canyon,” by GSA Senior Fellow Ivo Lucchitta & GSA Senior Fellow and 1972 GSA President (deceased) Luna B. Leopold (April).

2000: “Evaluating global warming: A post-1990s perspective,” by David S. Gutzler (October).

2001: “Experimental stratigraphy,” by GSA Fellow Chris Paola & colleagues (July).

2002: “Slow crawl across the salinity divide: Delayed colonization of freshwater ecosystems by invertebrates,” by GSA Fellow Molly Fritz Miller & Conrad C. Labandeira (December).

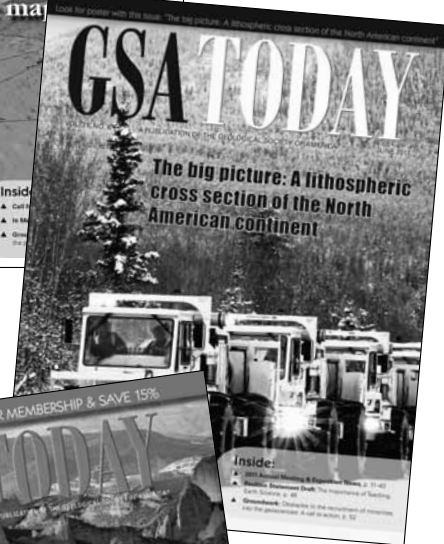
2003: “Landslides and liquefaction triggered by the M7.9 Denali fault earthquake of 3 November 2002,” by Edwin L. Harp & colleagues (August).

2004: “Submergence of ancient Greek cities off Egypt’s Nile Delta—A cautionary tale,” by GSA Senior Fellow Jean-Daniel Stanley & colleagues (January).

2005: “Urban lead poisoning and medical geology: An unfinished story,” by Gabriel M. Filippelli & colleagues (January).

2006: “The 1906 earthquake and a century of progress in understanding earthquakes and their hazards,” by GSA Fellow and 2000 GSA President Mary Lou Zoback (April/May).

2007: “Is agriculture eroding civilization’s foundation?,” by GSA Fellow David R. Montgomery (October).



You can read all 232 articles for FREE at www.geosociety.org/gsatoday/science.htm. GSA Fellows and Senior Fellows have been noted within the online listing.

Call for Proposals

GSA DIVISION AWARDS

■ STEPHEN E. LAUBACH STRUCTURAL DIAGENESIS RESEARCH AWARD FUND

Deadline for proposals: 15 April

The Stephen E. Laubach Structural Diagenesis Research Award Fund promotes research combining structural geology and diagenesis, and curriculum development in structural diagenesis. The donors believe multidisciplinary approaches often reveal new insights into long-standing problems and expose productive avenues for enquiry. To help promote the cross disciplinary emphasis of this annual award, the Sedimentary Geology and Structural Geology & Tectonics Divisions have been designated to jointly select the recipient. Graduate students, postgraduate, and faculty-level researchers are eligible. Learn more at <http://rock.geosociety.org/sgt/Laubach.htm>.



■ HISTORY AND PHILOSOPHY OF GEOLOGY STUDENT AWARD

Award amount: US\$1,000

Deadline: 1 May

The History and Philosophy of Geology Division offers this award for a student paper to be presented at an upcoming GSA Annual Meeting. The topic of the proposed paper may be, but is not limited to, (1) the history of geology; (2) a literature review of ideas for a technical work or thesis/dissertation; or (3) some imaginative aspect of the history of geology we have not thought of before. Consideration will be given to both undergraduate and graduate students who are in good standing at the time of application, and the GSA Annual Meeting presentation may take place after graduation. Faculty advisor(s) may not be listed as the lead author of the paper, and while both oral and poster presentations are acceptable, oral presentations are preferred.

Proposal guidelines and the application form are online at <http://gsahist.org/HoGaward/awards.htm>. If you have questions, please contact the Division secretary-treasurer, Jane P. Davidson, jdhexen@unr.edu. This award is made possible by a bequest from the estate of Mary C. Rabbitt. Nominees need not be members of this Division or of The Geological Society of America.

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BULLETIN

Call for Proposals

GSA DIVISION AWARDS

■ MINERALOGY, GEOCHEMISTRY, PETROLOGY, AND VOLCANOLOGY (MGPV) DIVISION DISTINGUISHED GEOLOGIC CAREER AWARD

Nominations due 15 July

This award honors an individual who 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. Geologic work is by nature generalistic and has an important field component, with Earth as the natural laboratory. Nominees need not be citizens or residents of the United States, and GSA membership is not required. The award will not be given posthumously.

Submit (1) a cover letter (no longer than 3 pages) from an MGPV Division member, summarizing the nominee's most important accomplishments in geologic approaches to mineralogy, geochemistry, petrology, and/or volcanology. Special attention should be paid to describing how the nominee's published work demonstrates field-based multidisciplinary geologic accomplishments of a ground-breaking nature. The letter should include the name, address, and contact information of the nominator as well as from whom letters of support can be expected; (2) curriculum vitae of the nominee; and (3) three letters of support either from members or non-members of GSA or the MGPV Division, to J. Alex Speer, Mineralogical Society of America, 3635 Concorde Pkwy, Suite 500, Chantilly, Virginia 20151-1110, USA; jaspeer@minsocam.org.

■ THE KERRY KELTS STUDENT RESEARCH AWARDS OF THE LIMNOGEOLOGY DIVISION

Award amount: US\$1,000

Deadline: 1 August

The Kerry Kelts Research Awards for undergraduate or graduate student research are named in honor of Kerry Kelts, a visionary limnogeologist and inspiring teacher. This year, one award is offered for research related to limnogeology, limnology, or paleolimnology. To apply, send a summary of the proposed research, its significance, and how the award will be used (five-page maximum) in PDF format along with a short (two-page maximum) CV to the chair of the Limnogeology Division, Amy E. Myrbo, amyrbo@umn.edu. Please include your name in all PDF file names that you send. Awards will be announced at the Limnogeology Division Business Meeting and Reception at the 2013 GSA Annual Meeting this October.

We hope to increase the number of these awards in the future; membership dues help with this important Division activity, but 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, P.O. Box 9140, Boulder, CO 80301-9140, USA, or visit www.gsaf-web.org/makeadonation.html and select the Kerry Kelts Student Research Award.

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You'll find links to GSA publications, photos, event information, the GSA blog "Speaking of Geoscience," and more.

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for a rewarding interactive experience while also receiving GSA updates and information.

LinkedIn

www.linkedin.com/groups/Geological-Society-America-1298547

GSA members and interested geoscience professionals can use this platform for discussion and networking opportunities.

www.geosociety.org/w2/

GSA International Distinguished Lecture Tour Update



Victor R. Baker, 2012–2013 GSA International Distinguished Lecturer

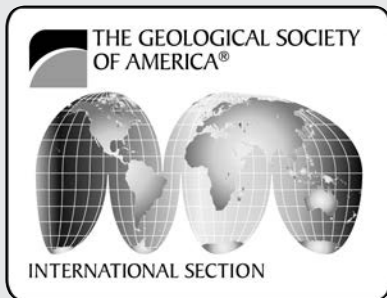
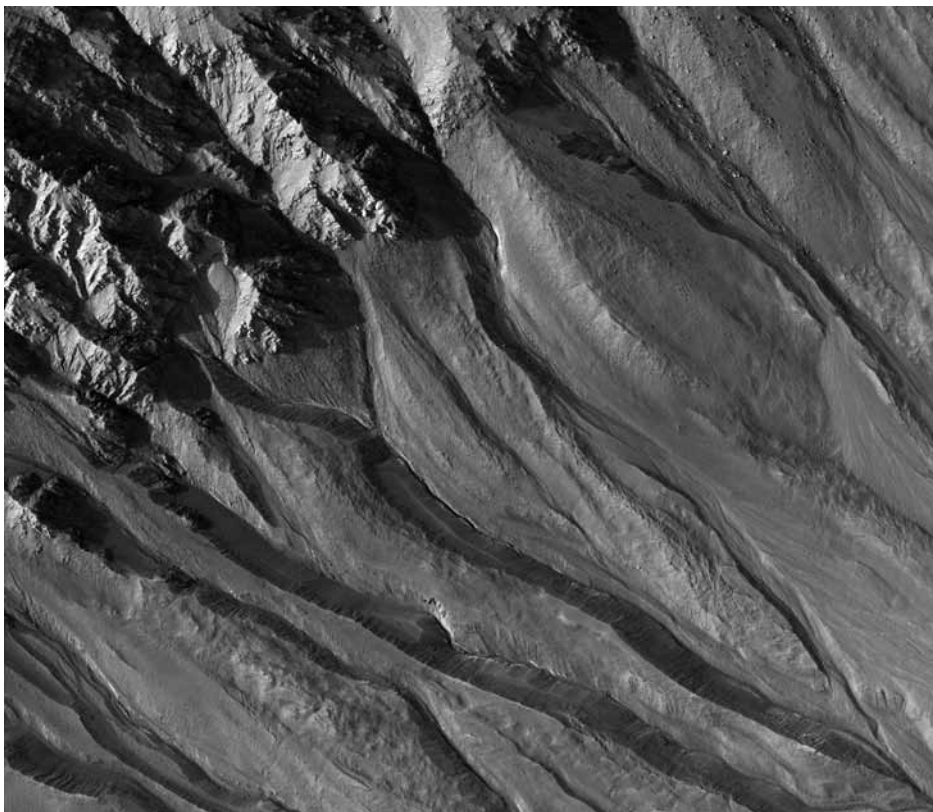
The Geological Society of America is proud to have launched the inaugural International Distinguished Lecture Tour in 2012, arranged under the guidance of GSA's International Section. As outlined in the Society's Strategic Plan, GSA seeks to be a leader in promoting programs that actively involve the global science community in fulfillment of our mission and goals. The International Section sought nominations through each of GSA's specialty science Divisions and then selected an outstanding, prestigious lecturer to send to invited universities and institutions throughout Europe. The Distinguished International Lecture Tour is made possible through a generous gift to the GSA Foundation.

The 2012–2013 Distinguished International Lecturer is Victor R. Baker, Regents Professor, Professor of Planetary Sciences and Geosciences at the University of Arizona. Baker gave lectures in 2012 on the topics of "Megafloods on Earth, Mars, and Beyond" and "Geological History of Water on an Earth-Like Planet."

To date, Baker has delivered 17 lectures on the two themes in England, Scotland, Finland, Sweden, the Netherlands, Italy, Israel, Germany, and France. Lecture dates and locations were posted and promoted through the GSA International Section webpage. Approximately 1,000 students, faculty, and members of the general public attended the lectures; the lectures were also video recorded by several universities for an expanded future audience. As a result of the lectures in Israel, the Israel Geological Society has become a GSA Associated Society.

Baker will continue his lecture tour in May 2013 with plans to visit Italy, Ireland, and Spain. Please check the GSA International Section webpage for dates and detailed information: www.geosociety.org/Sections/International/LectureTour.htm. To learn more about the International Lecture program, contact Wesley Hill, whill@geosociety.org.

Gullies with characteristics of water-carved channels. False-color image of gully channels in a crater in the southern highlands of Mars, taken by the High Resolution Imaging Science Experiment (HiRISE) camera on the Mars Reconnaissance Orbiter. The gullies emanating from the rocky cliffs near the crater's rim (upper left) show meandering and braided patterns typical of water-carved channels. North is approximately up and illumination is from the left. Credit: NASA/JPL/University of Arizona.



In Memoriam



The Society notes with regret the deaths of the following members (notifications received between 1 Nov. 2012 and 3 Feb. 2013).

Paul A. Bailly

Burlington, Vermont, USA
2 July 2012 (notified 31 Jan. 2013)

Aleksis Dreimanis

London, Ontario, Canada
30 Nov. 2012

Benjamin P. Flower

St. Petersburg, Florida, USA
1 July 2012 (notified 15 Jan. 2013)

R. Gordon Gastil

Julian, California, USA
29 Sept. 2012 (notified 4 Dec. 2012)

John C. Gries

Wichita, Kansas, USA
18 Jan. 2013

Charles J. Hoke

El Dorado, Arkansas, USA
30 Dec. 2012

William P. Irwin

Temecula, California, USA
1 Feb. 2012 (notified 4 Feb. 2013)

Hugh C. Morris

Delta, British Columbia, Canada
23 Dec. 2012

B.P. Radhakrishna

Bangalore, Karnataka, India
26 Jan. 2012 (notified 20 Dec. 2012)

Foster D. Smith

Miami, Florida, USA
19 Dec. 2012

Richard L. Threet

Anacortes, Washington, USA
12 Dec. 2012

Martin Weiss

Fairfax, Virginia, USA
22 Jan. 2013

Hendrik J. Zwart

Leersum, Netherlands
18 Nov. 2012



To honor a friend or colleague with a GSA Memorial, please go to www.geosociety.org/pubs/memorials/mmlGuid.htm to learn how. Contact the GSA Foundation, www.gsafweb.org, if you would like to contribute to the Memorial Fund.

About People

GSA Senior Fellow **J. William Schopf** of the University of California, Los Angeles, has earned the National Academies of Science Award in Early Earth and Life Sciences, presented this year with the Charles Doolittle Walcott Medal. Schopf is being honored for his studies of the microscopic fossils that represent the earliest forms of life on Earth and for his generous and inspirational leadership of large, collaborative research groups. Schopf will receive the award on 28 April 2013, during the 150th annual meeting of the National Academies of Science. Learn more at www.nasonline.org/news-and-multimedia/news/jan-7-2013-NASawards.html.

GSA Senior Fellows **John J. Amoruso**, **Richard S. Bishop**, **Robert L. Folk**, **Miles O. Hayes**, and **George Devries Klein** have been named the Houston Geological Society's (HGS) 2013 "Legends of Sedimentology." **Amoruso** is a past president of the American Association of Petroleum Geologists (AAPG) and the inaugural recipient of AAPG's Michel T. Halbouty

Outstanding Leadership Award. **Bishop**, an exploration geologist, is also a past AAPG president. **Folk** is professor emeritus at The University of Texas at Austin and GSA's 2000 Penrose Medalist. **Hayes** is a coastal geomorphologist and co-author of the book *A Coast for All Seasons*. **Klein** is both president of SED-STRAT Geoscience Consultants, Inc. in Katy, Texas, USA, and professor emeritus of geology at the University of Illinois at Urbana-Champaign. Learn more at www.hgs.org/multimedia_Legends.

Learn more about the achievements of GSA members at www.geosociety.org/news/memberNews.htm, and send your stories to gsatoday@geosociety.org.

Help Celebrate GSA's Role in Advancing the Geosciences through Your Gifts of Time and Talent

2014–2015 COMMITTEE VACANCIES

Deadline to apply or submit nominations: 15 July

GSA invites you to volunteer or nominate one of your fellow GSA members to serve on a Society committee or as a GSA representative to another organization. Learn more about each committee and access the nomination form at www.geosociety.org/aboutus/committees/. You can also download the form and send a hardcopy nomination to Pamela Fistell, P.O. Box 9140, Boulder, CO 80301-9140, USA; fax: +1-303-357-1074; phone: +1-303-357-1044 or +1-800-472-1988 ext. 1044. **Terms begin 1 July 2014** (unless otherwise indicated).

ACADEMIC AND APPLIED GEOSCIENCE RELATIONS

Three members-at-large vacancies (3-year terms; AM, T/E)

This committee is charged with strengthening and expanding relationships between GSA members in applied and academic geosciences. As such, it proactively coordinates the Society's effort to facilitate greater cooperation between academia, industry, and government geoscientists. **Qualifications:** Members must work in academia, industry, or government and be committed to developing better integration of applied and academic science in GSA meetings, publications, short courses, field trips, and education and outreach programs. Members must also be active in one or more GSA Divisions.

ANNUAL PROGRAM

Two members-at-large vacancies (4-year terms; AM, B/E)

This committee develops a long-range plan for increasing the quality of the annual meeting and other Society-sponsored meetings in terms of science, education, and outreach, and it evaluates the technical and scientific programs of the annual meeting. **Qualifications:** Members must have a broad familiarity with different disciplines as well as previous program experience or active involvement in applying geologic knowledge to benefit society and to raise awareness of critical issues.

ARTHUR L. DAY MEDAL AWARD

Two members-at-large vacancies (3-year terms; T/E)

This committee selects candidates for the Arthur L. Day Medal Award. **Qualifications:** Members should have 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

Three members-at-large and one councilor vacancies (3-year terms; AM, T/E)

This committee provides advice and support to GSA Council and initiates activities and programs that will increase opportunities for people of ethnic minority, women, and persons with disabilities and raise awareness in the geoscience community of the positive role these groups play within the geosciences. The committee is also charged with stimulating recruitment and promoting positive career development for these groups. **Qualifications:** Members must be familiar with the employment issues these groups face; expertise and leadership experience in such areas as human resources and education is also desired.

EDUCATION

Three representative vacancies: one informal science educator, one graduate educator (4-year terms), one undergraduate student (2-year term) (AM, B/E, T/E)

This committee works with GSA members representing a wide range of education sectors to develop informal, pre-college (K–12), undergraduate, and graduate earth-science education and outreach objectives and initiatives. **Qualifications:** Members must have the ability to work with other interested scientific organizations and science teachers' groups.

eGSA

Two members-at-large vacancies (one M.S. student and one Ph.D. student) (3-year terms; AM, T/E)

This committee is charged with improving communications with and among all GSA stakeholders. **Qualifications:** Members must have experience beyond basic e-mail and telephone media, such as SMS (texting) and MMS (multi-media messaging service), and facility with social networks, virtual communities, blogs, and other emerging technologies.

GEOLOGY AND PUBLIC POLICY

Two vacancies: one member-at-large (3-year term) and one student representative (2-year term) (AM, B/E & T/E)

This committee provides advice on public policy matters to Council and GSA leadership by monitoring and assessing international, national, and regional science policy; formulating and recommending position statements; and sponsoring topical white papers. This committee also encourages the active engagement in geoscience policy by GSA members. **Qualifications:** Members should have experience with public-policy issues involving the

AM—Meets at the Annual Meeting • B/E—Meets in Boulder or elsewhere

C—Extensive time commitment required during application review period (15 Feb.–15 Apr. 2015) • T/E—Communicates by phone or electronically

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

Two vacancies: one paleoceanology/paleoclimatology representative and one Precambrian geology representative (2-year terms run 1 Dec. 2013–30 Nov. 2015; T/E)

Members of this committee help finalize GSA's annual meeting technical program by participating in the Web-based selection and scheduling of abstracts as well as topical session proposal review. **Qualifications:** Members must be familiar with computers and the Web, be a specialist in one of the specified fields, and be available in late July–mid-August for the organization of the annual meeting technical program.

MEMBERSHIP

Three vacancies: one member-at-large (academia), one member-at-large (industry) and one student (3-year terms; B/E)

This committee draws its members from academia, industry, and government; contributes to the growth of GSA membership; and attends to the changing needs of Society members by focusing on attracting and retaining students, professionals working in industry, and those studying and working outside the United States. This committee also reviews and makes recommendations for Fellowship to Council. **Qualifications:** Members should have experience in benefit, recruitment, and retention programs.

NOMINATIONS

One member-at-large vacancy (3-year term; B/E & T/E)

This committee recommends nominees to GSA Council for the positions of GSA Officers and Councilors, for committee members, and for Society representatives to other permanent groups. **Qualifications:** Members must be familiar with a broad range of well-known and highly respected geoscientists.

PENROSE CONFERENCES AND FIELD FORUMS

One member-at-large vacancy (3-year term; T/E)

This committee reviews and approves Penrose Conference and Field Forum proposals and recommends and implements guidelines for the success of these meetings. **Qualifications:** Members must be past conveners of a Penrose Conference or Field Forum.

PENROSE MEDAL AWARD

Two members-at-large vacancies (3-year terms; T/E)

Members of this committee select candidates for the Penrose Medal. Emphasis is placed on eminent research in pure geology that marks a major advance in the science of geology. **Qualifications:** Members should be familiar with outstanding achievers in the geosciences worthy of consideration for the honor.

PROFESSIONAL DEVELOPMENT

Two members-at-large vacancies (3-year terms; T/E)

This committee 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:** Members must be familiar with professional development programs or have adult education teaching experience.

GSA PUBLIC SERVICE AWARD

One member-at-large and one councilor vacancy (3-year terms; T/E)

This committee generates, receives, and evaluates candidates for the GSA Public Service Award and the AGI Outstanding Contribution to the Public Understanding of the Geosciences Award. These awards are given in recognition of outstanding individual contributions to either public awareness of the earth sciences or the scientific resolution of earth-science problems of significant societal concern. A crucial factor is to recognize an individual who highlights distinction between knowledge and understanding. **Qualifications:** Members should be familiar with those whose contributions and accomplishments have enhanced the public's understanding of earth science.

PUBLICATIONS

Three vacancies: one member-at-large young professional, one member-at-large, and one councilor (4-year terms; AM, B/E & T/E)

This committee nominates candidates for science editor positions, approves editorial boards, reviews the quality and health of Society publications, and explores the initiation of new ventures, including electronic publishing. **Qualifications:** Members must have extensive publications experience.

RESEARCH GRANTS

Eleven members-at-large vacancies (3-year terms; B/E;C)

Committee members evaluate student research grant applications and select grant recipients. **Qualifications:** Members should have experience in directing research projects and in evaluating research grant applications. **Extensive time commitment required** 15 Feb.–15 Apr. 2015.

YOUNG SCIENTIST AWARD (DONATH MEDAL)

One member-at-large vacancy (3-year term; T/E)

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

continued on page 50

Call for GSA Committee Service

continued from page 49

GSA REPRESENTATIVES TO OTHER ORGANIZATIONS

AAAS Consortium of Affiliates for International Programs (CAIP)

One vacancy (3-year term begins 1 January 2014; B/E)

CAIP encourages cooperation on projects with international aspects and facilitates networking in its member societies.

Qualifications: The GSA representative must have an interest in the international aspects of his/her Society.

AAPG Publication Pipeline Committee

One vacancy (3-year term begins 1 July 2014; B/E)

The GSA conferee should be able to provide advice to assist the committee in their efforts to improve task processes and to spread the word of their activities to retired or other GSA members who wish to dispose of books for donation to overseas libraries.

AGI Environmental Geoscience Advisory Committee (EGAC)

One vacancy (3-year term begins 1 January 2014; AM/T/E)

The GSA representative should be able to foster communication about issues related to serving the broader international community and help identify and focus on the highest priority environmental informational needs and issues that are best addressed by the geoscience community. **Qualifications:** The representative must be well-acquainted with GSA programs in environmental geoscience.

North American Commission on Stratigraphic Nomenclature

One vacancy (3-year term begins Nov. 2014–Nov. 2017; AM, possibly B/E)

This committee 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, and formulates expressions of judgment on these matters.

NOTICE of Spring 2013 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 Saturday, 27 April, 3–4:30 p.m.; and Sunday, 28 April, 8 a.m.–noon. The GSA corporate meeting will be Saturday, 27 April, 4:30–5 p.m. All meetings will be held in the Boulder, Colorado, USA, area with exact locations to be announced at a later date.




3300 Penrose Place, Boulder, CO 80301-9140, USA
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Call for Nominations: 2014 Officers and Councilors

Deadline: 15 July

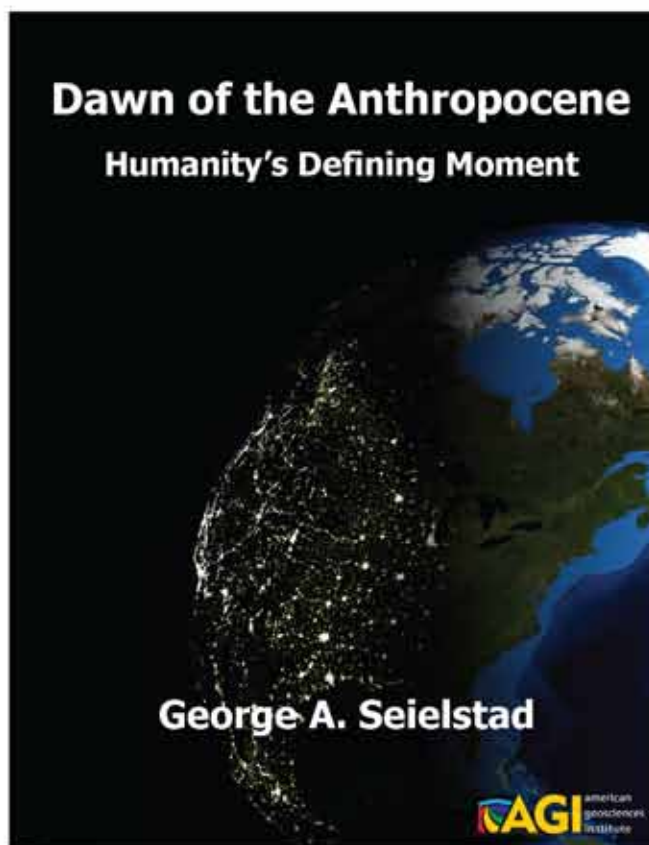
The GSA Committee on Nominations requests your recommendations for GSA Officers (Vice President/President Elect and Treasurer) and Councilors to serve beginning in 2014. Each nomination should be accompanied by basic data and a description of the individual's qualifications. You can access the online nomination form at www.geosociety.org/aboutus/officers.htm or you may send nomination materials to Pamela Fistell, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA, pfistell@geosociety.org.

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GSA FOUNDATION UPDATE

P. Geoffrey Feiss, GSA Foundation President

The Foundation has bid farewell to Anna Christensen, who joined our staff in July 2010 as chief development officer. She resigned effective 31 December 2012 to turn her attention to starting a family—an activity somewhat at odds with the travel requirements of development work. She made enormous contributions to the Foundation, and we will miss her professionalism and her wonderful personality.

Filling her role is Chris Tallackson, who joined the Foundation as director of development in January 2013. Tallackson's background includes experience in higher education fundraising and alumni relations, clean energy program management, and engineering sales. He is looking forward to working with members to strengthen GSA's ability to advance the geosciences for the next 125 years.

A native of the Pacific Northwest, Tallackson is now settling into Colorado's Front Range with his wife Barbara, a native of Ketchum, Idaho, USA, and daughter, Hadley (16). He holds a B.A. in economics from Whitman College in Walla Walla, Washington, USA, and recently earned his M.A. in public administration from the University of Utah. In his spare time, Tallackson enjoys skiing, fly fishing, and extreme dog walking.

Tallackson's primary focus will be working with GSA members to align their philanthropic goals with effective programmatic opportunities at GSA through major gifts and bequests. He will also focus on growing membership in the Penrose Circle, supporting special projects, and expanding annual support from all members. His fundraising experience includes working with



Anna Christensen



Chris Tallackson

geoscientists from the Utah State University Department of Geology, where he helped build donor awareness and participation in the Benchmark Society. He previously worked at his alma mater coordinating major gifts, planned gifts, and annual giving programs supporting scholarships, internships, and a variety of capital projects.

In addition to fundraising, Tallackson has recent experience managing renewable and energy efficiency programs in Utah. These programs delivered more than 500 new photovoltaic installations and 1,100 whole-home energy efficiency upgrades in less than two years.

Tallackson notes that "support from individuals at all levels is essential to strengthening GSA's programs and priorities to advance the geosciences. I look forward to working with GSA members to help them participate in this important effort." Tallackson can be contacted at ctallackson@geosociety.com.

Test your GSA knowledge!

- 1 Name a GSA Executive Director whose father was a fellow of the GSA. Hint: He also served as Editor of the GSA Bulletin.
- 2 When and where was the first Penrose Conference and who organized it?



Please submit answers by the end of the month to gsaf@geosociety.org

One winner will be selected each month to receive a copy of *GeoTales V: A Collection of Stories & Memories Written by GSA Members*.

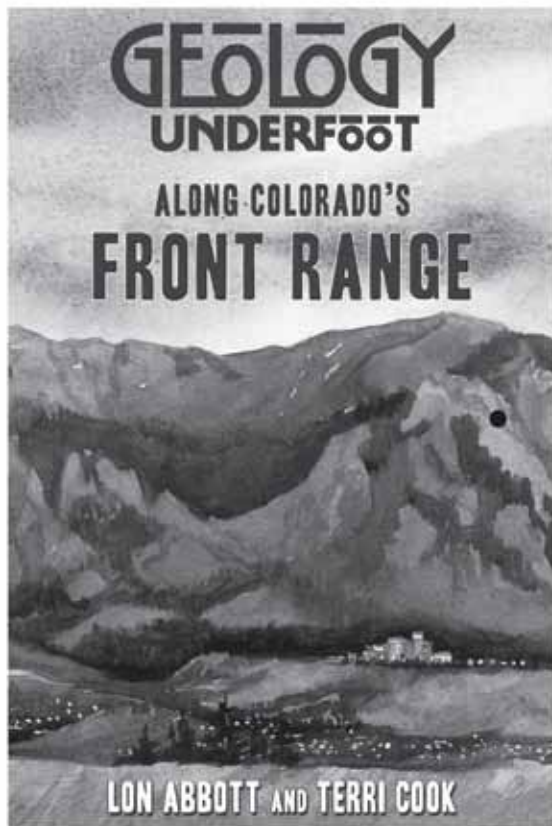


GSA FOUNDATION'S 2013 SILENT AUCTION

This year's Silent Auction is joining GSA's 125th Anniversary GIVE 125 challenge, and we need your help to reach our goals! We're seeking items that broadly pertain to the geosciences. Proceeds from the Silent Auction will help support GSA Diversity in the Geosciences Committee projects.

- Help us build our "well-equipped geoscientist" area, from head to toe, classroom to field—with tools, field supplies, gear, software;
- Add to the collection of geologic specimens;
- Contribute to our selection of wine & wine accessories;
- People always appreciate gift certificates (e.g., Amazon, special events, trips, restaurants);
- GSA meeting attendees love books; and
- Geo-gifts, jewelry, and apparel donations are great for our pre-holiday meeting.

To make a donation, or if you have any questions, please contact Ann Crawford, acrawford@geosociety.org; +1-800-472-1988, ext. 1053, or +1-303-357-1053.



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GeoCorps™ America 2012 Highlights

“What is that?” “What are you doing?” “Are you tracking sharks? Whales?”

These are the types of questions that Rachael Dye would be asked as she was setting up her station along the sandy beaches of Cape Cod National Seashore. When she explained that she was monitoring erosion trends for the National Park Service, visitors to the area showed a lot of interest in her work and results.

Dye was one of more than 120 GeoCorps participants conducting geoscience projects on public lands throughout the United States in 2012. Visitors to National Parks, National Forests, and Bureau of Land Management areas all around the country have seen GeoCorps participants leading cave tours, inventorying springs, operating telescopes, locating dinosaur trackways, excavating fossils, measuring coast lines, monitoring glaciers, and carrying out various other geoscience-related activities.



Rachael Dye, Coastal Geologist, National Park Service (NPS), Cape Cod National Seashore, North Truro, Massachusetts, USA

Dye’s responsibilities included data collection, data entry, and data analysis for three projects: coastal erosion monitoring, salt marsh erosion monitoring, and kettle pond erosion monitoring. She worked extensively in the field and used MS Excel, ArcGIS, and other software to analyze data and run comparisons between old and new measurements. Dye presented her research at the Northeast Arc User’s Conference (NEARC) in a poster titled “Using Real-Time Kinematic GPS and LiDAR to Survey Outer Cape Cod’s Changing Coast.” Her poster received both the Judge’s Choice award for Best Poster and the People’s Choice award for Best Poster—the first time in the history of the conference that one poster won both awards.

Susan Bresney, Hydrologic Technician, Bureau of Land Management (BLM), Gunnison Field Office, Gunnison, Colorado, USA

Bresney worked on a spring inventory that would be used for land health assessments and securing water rights. Using a 30+ year-old spring survey as a starting point, she quickly learned how to mesh old data with new technologies, along with her geologic intuition, to be able to accurately and efficiently locate springs. Bresney’s field and data analysis skills impressed her supervisors so much that the BLM extended her project an additional three months, and at the conclusion of her project, awarded her with a Letter of Recognition for outstanding work.

Griffin Heard, Interpretive Geologist, U.S. Forest Service, Klamath National Forest, Yreka, California, USA

Heard worked alongside U.S. Forest Service geologists to develop educational and interpretive programs for the Klamath National Forest. She spent hours conducting field and literature-based research on the geologic resources and hazards present in the forest and then developed a series of interpretive materials and programs for forest personnel and visitors. One of the highlights of her work is a series of excellent EarthCaches—field locations that people can visit for self-guided geologic lessons (see www.earthcache.org).



Vanessa Calder, Brett Sherman, and Sean McCartney, Abandoned Mine Lands (AML) Program Assistants, State of California Department of Conservation, Sacramento, California, USA

Calder, Sherman, and McCartney work as a team to assist state staff in carrying out field inventories and data collection at abandoned mine sites located on public lands throughout California. Their work has taken them to some beautiful but seldom-seen areas in places like Death Valley National Park, Joshua Tree National Park, and the Mojave National Preserve. Along the way, they’ve encountered bees, bats, unstable mine areas, and some great geology. By the time they are done, they will have helped the California AML program inventory hundreds of potentially dangerous abandoned mine sites, thus allowing the state to begin risk mitigation.



New GeoCorps Positions Available For Fall/Winter 2013–2014

Fall/winter 2013–2014 GeoCorps positions will be posted online on 1 May, and applications can be submitted until 1 July. GeoCorps positions generally last for three months (sometimes longer), offer a US\$3,000 stipend, include free housing (or a housing allowance), and in some cases, a travel allowance.

To apply, go to www.geosociety.org/geocorps. For more information, visit us on Facebook (www.facebook.com/geocorps), follow us on Twitter (www.twitter.com/geocorps), or contact Matt Dawson at mdawson@geosociety.org or +1-303-357-1025.

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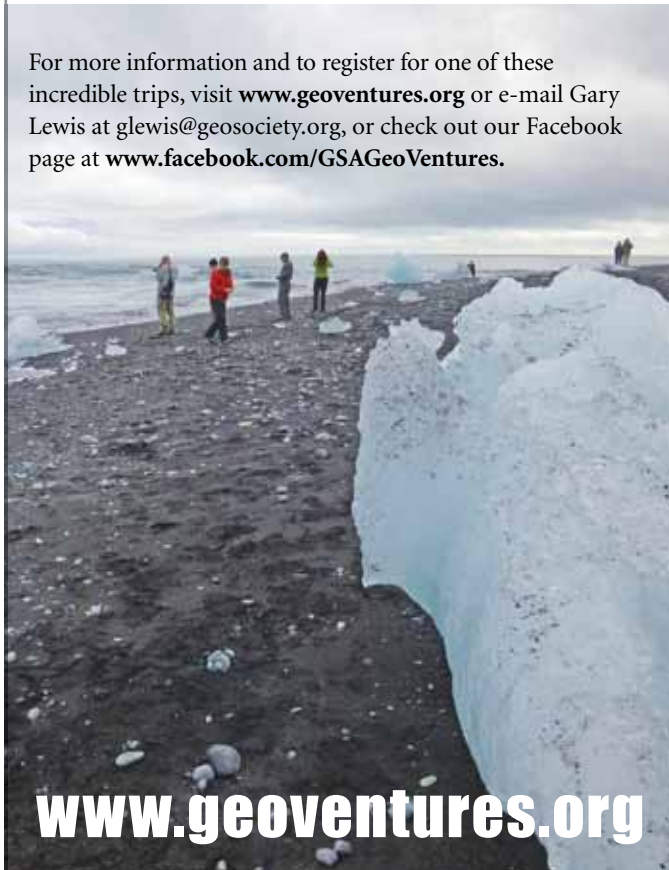
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GeoVenture participants walking on a black sand beach in southern Iceland, near the outlet of the glacial lagoon Jökulsárlón. The ice in the foreground represent pieces of the Breiðamerkurjökull glacier. Photo by Matt Dawson.

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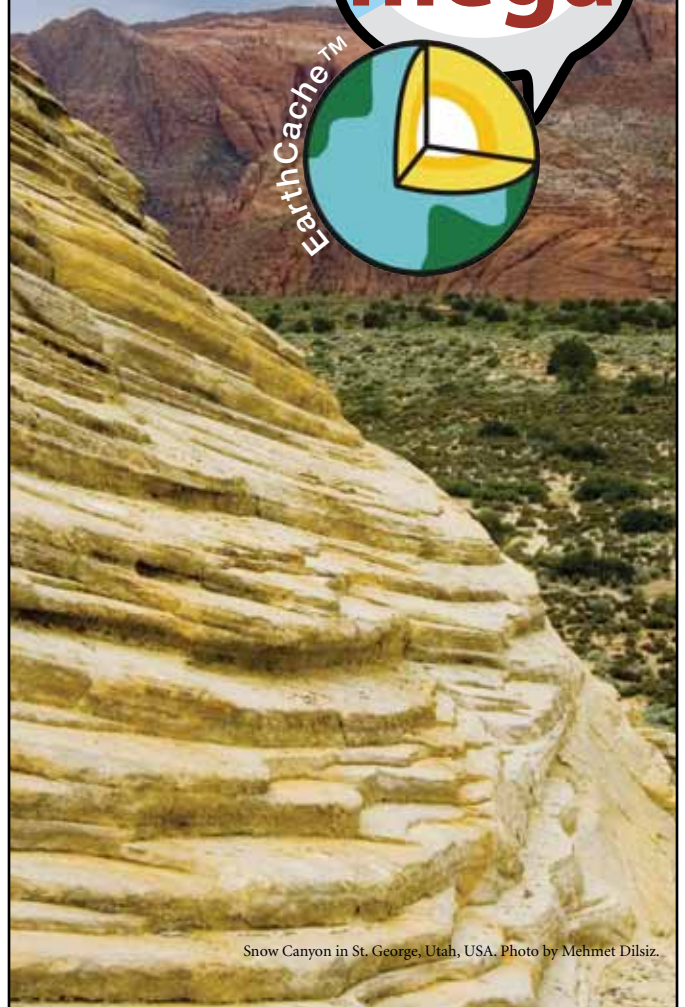
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E-mail inquiries should be directed to Dr. Herb Grover, Dean, School of Mathematics and Sciences, at groverh@wbu.edu.

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The Department of Geology and Environmental Geosciences at Lafayette College invites applications for a full-time sabbatical leave replacement for academic year 2013–2014 with expertise in paleo-

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The review process will begin immediately and continue until an individual is selected. Candidates should submit a letter of application, statement of teaching interests, vita, college and graduate school transcripts and three letters of reference to Dru Germanoski, germanod@lafayette.edu or Department of Geology and Environmental Geosciences, Lafayette College, Easton, PA 18042. Lafayette College is committed to creating a diverse community: one that is inclusive and responsive, and is supportive of each and all of its faculty, students, and staff. All members of the College community share a responsibility for creating, maintaining, and developing a learning environment in which difference is valued, equity is sought, and inclusiveness is practiced. Lafayette College is an equal opportunity employer and encourages applications from women and minorities.

PETROLEUM GEOLOGIST TEXAS A&M UNIVERSITY AT QATAR PETROLEUM ENGINEERING PROGRAM EDUCATION CITY, DOHA, QATAR

The Petroleum Engineering Program of Texas A&M University at Qatar (TAMUQ) (<http://pete.qatar.tamu.edu/Pages/default.aspx>) invites applications for the position of assistant, associate or full professor in Petroleum Geology at the TAMUQ campus, Doha, Qatar. The anticipated start date is September 1, 2013. This appointment initially is a two-year renewable contract; faculty are eligible for a long-term rolling contract after a probationary period.

The sought faculty member will be expected to: (1) teach required core-curriculum geology courses for petroleum engineering; (2) co-teach the senior-design petroleum engineering project course, PETE400; (3) teach additional geology courses for students seeking a minor in Geosciences; (4) establish an externally funded research program in geoscience; (5) contribute to the establishment of a geoscience major if and when the decision is made to begin a program; and (6) provide additional service to the Program, University, and community as appropriate.

Texas A&M at Qatar (TAMUQ) is a partnership with Qatar Foundation, and is based in a modern 595,000 square-foot building completed in 2007. TAMUQ offers undergraduate degree programs in Mechanical, Electrical, Chemical, and Petroleum Engineering. The programs attract many of the best high school graduates in the region. The ABET-accredited Petroleum Engineering Program (<http://pete.qatar.tamu.edu/>) currently has 8 faculty members. The program benefits from state-of-the-art facilities and instrumentation in support of its educational and research missions.

Applicants must have an earned doctorate in geology and experience in petroleum geoscience or a related area. The successful candidate is expected to

have a strong commitment to teaching excellence at the undergraduate and graduate levels, and a demonstrated research capability that will enable the candidate to develop an independent research program and publish in leading scholarly journals.

TAMUQ offers a competitive salary package commensurate with rank and experience. The package includes 12-month salary, overseas salary premium, housing, annual home leave allowances, dependent education, local transportation allowance, medical insurance, plus appropriate relocation and repatriation expenses.

Candidates should submit applications electronically (a single PDF file consisting of cover letter, CV, 1 pg. teaching philosophy, 1 pg. research philosophy and plans, 3 journal publications, and list of 3 references) to: Dr. Vassilios C. Kelessidis, PETE Chair Search Committee, Texas A&M University at Qatar, Education City, PO Box 23874, Doha, Qatar, +974-4423-0657, vassilios.kelessidis@qatar.tamu.edu.

Review of applications will begin immediately and will continue until the position is filled.

Texas A&M University is an Affirmative Action/Equal Opportunity Employer. The university is dedicated to the goal of building a culturally diverse and pluralistic faculty and staff committed to teaching and working in a multicultural environment, and strongly encourages applications from women, minorities, individuals with disabilities, and covered veterans. Employer paid advertisement.

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Applicants should submit a curriculum vitae, one to two-page descriptions of research and teaching plans, and the names, email addresses, and phone numbers of three professional referees. Applicants should not ask their referees to upload letters at the time of application; letters will be requested directly by MIT. Questions may be addressed to Prof. Samuel Bowring, Search Committee Chair, at sbowring@mit.edu. Applications are being accepted at Academic Jobs Online (<https://academicjobsonline.org/ajo>). To receive consideration, a complete application must be received by May 31, 2013.

Search Contact: Mr. Michael Richard, HR Administrator, EAPS, 54-912, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139-4307; mjr@mit.edu; +1-617-253-5184 (tel), +1-617-253-8298 (fax).

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of paleoclimate through an integrated series of lectures, investigations, case studies, and field and laboratory analyses. To promote U.S. graduate student participation in this international experience, the NSF Geoscience Divisions and the Office of International Science and Engineering are funding ten scholarships to cover U.S. carrier airfare, stipend, and course expenses (including lodging). Interested students in U.S. graduate programs should email a one-page CV and one-page statement on how the program would benefit their professional development as a researcher and educator to nsfusspscholarship@gmail.com. In addition, students should request their primary adviser to email a recommendation letter directly to the above email address. Members of historically underrepresented groups are encouraged to apply. Deadline for receipt of all application material, including recommendation letters, is 1 May 2013.

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The deadline for U.S.-affiliated scientists to apply to sail on these expeditions is May 1, 2013. For more information and to apply, please visit: www.iodp-ussp.org/sail. Scientists from other IODP-member countries can apply by visiting www.iodp.org/program-member-offices to locate their IODP Program Member Office.



CANADA EXCELLENCE RESEARCH CHAIR IN GEOFLUIDS IN SEDIMENTARY BASINS

Department of Geological Sciences and Geological Engineering
Faculty of Arts and Science and Faculty of Engineering and
Applied Science



One of Canada's leading universities, Queen's has a long-standing reputation for academic excellence, research, and a diverse and vibrant learning environment. With its strong tradition of public service, the University has helped to shape Canadian values and policies, educating notable political and cultural figures.

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The CERC holder will complement existing strengths by examining the details of fluid-rock interactions on all scales, from modeling large scale fluid flow in (hydrocarbon-bearing) sedimentary basins, to the origin and character of both mineralizing and barren fluids associated with energy-related commodities, to the pressure and chemical evolution of strata-bound fluids during earth history and into the future, to geochemical interactions between fluids and both natural and engineered materials. The Chair holder would focus on one, or both, of two major themes: (1) Energy and Mineral Resources (fluid evolution of sedimentary basins that potentially host petroleum and mineral deposits and exploration for buried deposits in basins); (2) Protecting and Managing the Environment (assessing element cycles in the environment that involve basins on all scales, or evaluating factors that affect waste disposal in sedimentary basins).

The successful candidate will be required to maintain a leading-edge research program, take a leading role in developing the GeoFluids program at Queen's, actively engage with industry, supervise graduate students, teach undergraduate and graduate courses, and make administrative contributions through service to the University, Faculty, and Department. Candidates must hold a relevant Ph.D. degree and have a demonstrated excellence in research, teaching and training of highly qualified personnel. Established research collaborations with industry and engagement in public policy will be considered an asset. Registration as a Professional Geoscientist or as a Professional Engineer in Ontario, or eligibility to acquire registration in Ontario is strongly encouraged.

Interested applicants are directed to the full details of the advertisement at:
www.queensu.ca/geol/department/employment.html

Applicants should send their curriculum vitae, contact information, the names of three referees including their contact information, along with a statement of research and teaching interests, and three examples of relevant publications to:

Dr. Cynthia Fekken, Chair, CERC GeoFluids Appointment Committee
Associate Vice-Principal (Research), Office of the Vice-Principal (Research)
251 Richardson Hall, Queen's University, Kingston, ON, Canada K7L 3N6
By email: fekken@queensu.ca

Review of applications will begin on April 1st, 2013.
Applications will be accepted until the position is filled.

The University invites applications from all qualified individuals. Queen's is committed to employment equity and diversity in the workplace and welcomes applications from women, visible minorities, aboriginal people, persons with disabilities, and persons of any sexual orientation or gender identity. All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents of Canada will be given priority. The academic staff at Queen's is governed by a collective agreement between QUFA and the University, which is posted at www.qufa.ca.

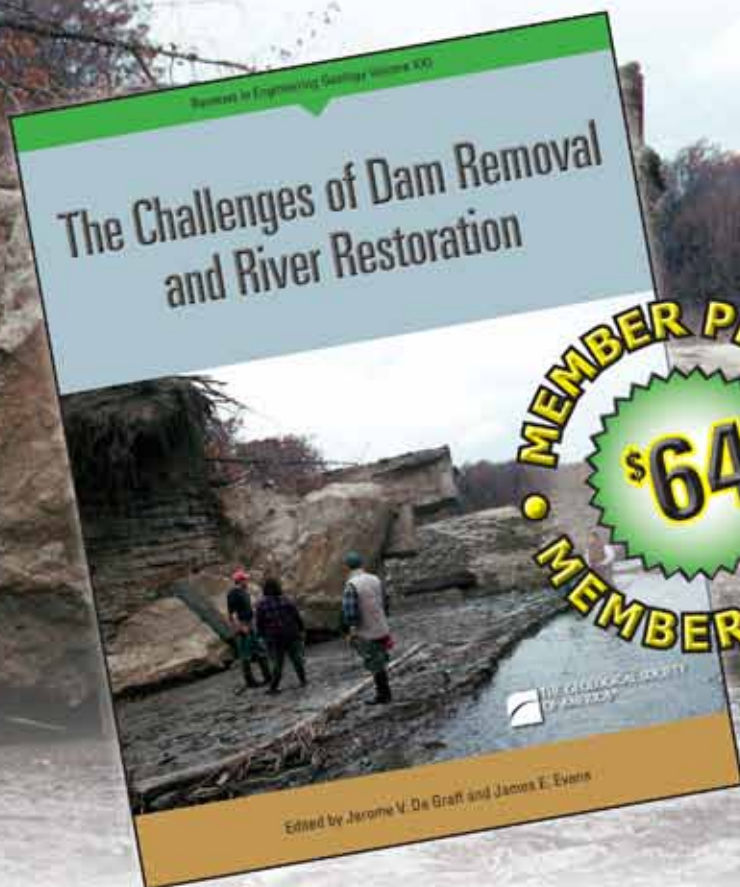
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How good do natural hazard assessments need to be?

Seth Stein, *Earth and Planetary Sciences, Northwestern University, Evanston, Illinois 60208, USA, seth@earth.northwestern.edu*; and **Jerome Stein***, *Applied Mathematics, Brown University, Providence, Rhode Island 02912, USA*

In trying to mitigate natural hazards, society plays a high-stakes game against nature. Often nature surprises us when an earthquake, hurricane, or flood is bigger or has greater effects than expected from detailed natural hazard assessments. In other cases, nature outsmarts us, doing great damage despite expensive mitigation measures.

These difficulties are illustrated by the March 2011 earthquake off Japan's Tohoku coast. The earthquake was much larger than anticipated from hazard maps and generated a tsunami much larger than anticipated, which overtopped coastal defenses, causing more than 15,000 deaths and US\$210 billion damage. Similar situations occur in predicting earthquake ground shaking (Stein et al., 2012), river floods (Merz, 2012), and other hazards (Pollack, 2003; Pilkey and Pilkey-Jarvis, 2007).

Society faces the challenge of choosing mitigation strategies, given that assessments of potential hazard have large uncertainties. This challenge is similar to that in national defense, involving choosing among expensive weapons and strategies to deal with poorly known future threats. Like defense planners, hazard planners must decide how much is enough (Enthoven and Smith, 1971; Goda and Hong, 2006).

We explore choosing strategies using a simple model comparing the costs and benefits of mitigation options (Stein and Stein, 2012). For example, given the damage to New York City by the storm surge from Hurricane Sandy, options under consideration range from continuing to do little through intermediate strategies like providing doors to keep water out of vulnerable tunnels to building barriers to keep the surge out of rivers. Progressively more extensive mitigation measures cost more but are expected to produce increasing reduction of losses in future hurricanes.

In our model, we denote the cost of mitigation as $C(n)$, where n is a measure of mitigation. The scale of a natural event is parameterized by h , such as the height of a storm surge, an earthquake's magnitude, or the level of the resulting ground shaking. The predicted annual economic loss, $L(h, n)$ increases with h and decreases with n . The annual probability of an event h is $p(h)$, so the present value of the expected loss is

$$Q(n) = \sum_h p(h)L(h, n) / i, \quad (1)$$

the sum of losses from different events weighted by their

probabilities. The hazard is described by $p(h)$, the occurrence of events of a certain size, and $Q(n)$ reflects the risk, which depends on the mitigation level n . Because the dates of future events are unknown, $L(h, n)$ is the expected average direct and indirect annual loss.

A sum of money S invested today at interest rate i will be worth $S(1+i)^t$ at a future time t , so the present value of a sum S at a future time t is the inverse, $S/(1+i)^t$. Thus, we scale the future losses to their present value using the sum over T years

$$D_T = \sum_t 1/(1+i)^t = [(1+i)^T - 1] / (i(1+i)^T) \approx 1/i \quad (2)$$

for large T . For interest rate $i = 0.05$, $D_T = 15.4$ for 30 years and 19.8 for 100 years. For long times, $1/i$ gives $D = 20$, essentially the same as for 100 years. Given the long lives of mitigation measures, $1/i$ is appropriate.

The optimum level of mitigation n^* minimizes the total cost $K(n)$, the sum of the expected loss and mitigation cost

$$K(n) = Q(n) + C(n). \quad (3)$$

The "U" shaped $K(n)$ curve illustrates the tradeoff between mitigation and loss (Fig. 1A). For no mitigation, $n = 0$, the total cost $K(0)$ equals the expected loss $Q(0)$. Initial levels of mitigation reduce the expected loss by more than their cost, so $K(n)$ decreases to a minimum at the optimum. $K(n)$ is steepest for $n = 0$ and flattens as it approaches the optimum, showing the decreasing marginal return on investment in mitigation. Relative to the optimum, less mitigation decreases mitigation costs but increases the expected damage and thus total cost, so it makes sense to invest more in mitigation. Conversely, more mitigation than the optimum gives less expected damage but at higher total cost, so the additional resources required could do more good if invested otherwise.

The optimum can be viewed using the derivatives of the functions, which for simplicity are shown as linear near the optimum (Fig. 1B). Because increasingly high levels of mitigation cost more, the marginal cost $C'(n)$ increases with n . Conversely, $-Q'(n)$, the reduced loss from additional mitigation, decreases. The lines intersect at the optimum, where

$$C'(n^*) = -Q'(n^*). \quad (4)$$

Although over-mitigation and under-mitigation are less efficient uses of resources than the optimum, a range of non-optimal solutions is still better than no mitigation. So long as $K(n)$ is below the dashed line $Q(0)$, the total cost is less than expected from doing

*Jerome Stein, Professor Emeritus of Economics at Brown University, died on 8 February 2013. During a long illness, he coauthored a series of papers and a forthcoming book on integrating geosciences and economics in natural hazard mitigation.

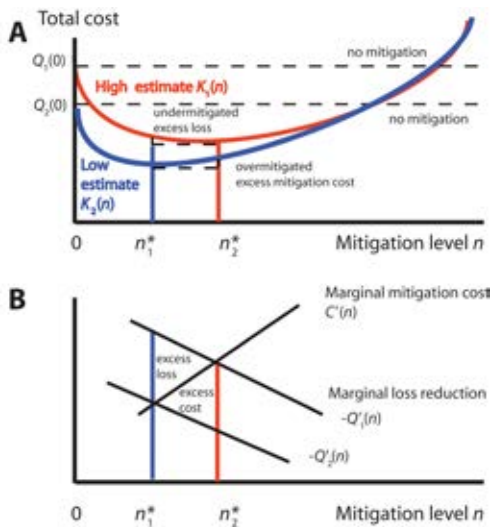


Figure 1. (A) Comparison of total cost curves for two estimated hazard levels. For each, the optimal mitigation level, n^* , minimizes the total cost, the sum of expected loss and mitigation cost. (B) In terms of derivatives, n^* occurs when the reduced loss $-Q'(n)$ equals the incremental mitigation cost $C'(n)$. If the hazard is assumed to be described by one curve but actually described by the other, the assumed optimal mitigation level causes non-optimal mitigation, and thus excess expected loss and/or excess mitigation cost. However, so long as the total cost is below the loss for no mitigation (dashed line), this non-optimal mitigation is better than none. Thus an inaccurate hazard estimate is useful as long as it is not too much of an overestimate.

no mitigation. The curve and line intersect again when

$$Q(0) = Q(n) + C(n), \quad (5)$$

which is where the benefit to society, the reduced loss compared to doing no mitigation $Q(0) - Q(n)$, equals the mitigation cost $C(n)$. Higher levels of mitigation cost more than their benefit and thus are worse than no mitigation.

Because our ability to assess natural hazards is limited, we consider a range of total cost curves between $K_1(n)$ and $K_2(n)$, corresponding to high and low estimates of the hazard. These start at different values, representing the expected loss without mitigation, and converge for high levels of mitigation as the mitigation costs exceed the expected loss.

In the limiting cases, the hazard is assumed to be described by one curve but is actually described by the other. As a result, the optimal mitigation level chosen for the assumed curve gives rise to non-optimal mitigation, shown by the corresponding point on the other curve. Assuming low hazard when higher hazard is appropriate causes under-mitigation and thus excess expected loss. Assuming high hazard when lower hazard is appropriate causes over-mitigation and thus excess mitigation cost. However, so long as this point is below the dashed line for the correct curve, the total cost is less than expected from doing no mitigation.

Given the range of hazard estimates, decision theory under deep uncertainty (Cox, 2012) suggests that society should choose an estimate between them. The resulting curve lies between the two curves and thus has a minimum between n_1^* and n_2^* . Relative to the actual but unknown optimum, the resulting mitigation is likely non-optimal but perhaps not unduly so. Moreover, so long as the total cost is below the actual loss for no mitigation, this non-optimal mitigation is better than no mitigation.

Hazard and loss modeling are subject to uncertainties with various causes. In addition to the uncertainty in the probability of future events, uncertainty in the expected loss results from uncertainty in specifically what occurs and how effective mitigation measures will be in reducing loss. For example, for an earthquake of a given magnitude, uncertainty arises in predicting both the ground shaking and the resulting damage. These uncertainties are typically characterized in overlapping terms, into epistemic uncertainties due to systematic errors and aleatory (alea is Latin for dice) uncertainties due to random variability about assumed means. In our formulation, the different cost curves can be viewed as illustrating epistemic uncertainties. Aleatory uncertainties can be viewed as variations about a curve and incorporated via a term that can also include the effects of risk aversion, which describes the extent to which we place greater weight on avoiding loss (Stein and Stein, 2012).

Because the “U” curves are the sum of loss and mitigation costs, uncertainties in loss estimation have the same effect as those in hazard estimation. Hence, the two cases can be viewed as high and low estimates of the loss for an assumed hazard. In reality, the range would reflect the combined uncertainty in hazard and loss estimates.

The analysis illustrates two crucial points. First, a non-optimal mitigation strategy—which is usually the case because the decisions are made politically rather than via economic analysis—still does more good than doing nothing as long as it is not so extreme that the mitigation costs exceed the benefit of reduced losses. Second, inaccurate hazard and loss estimates are still useful as long as they are not too much of an overestimate. Given that most natural hazards assessments and estimates of the resulting losses have large uncertainties, it is encouraging that any estimate that does not greatly overestimate the hazard and loss leads to a mitigation strategy that is better than doing nothing.

ACKNOWLEDGMENTS

We thank the U.S. Geological Survey John Wesley Powell Center for Analysis and Synthesis for hosting a working group that inspired this work, and John Adams, John Geissman, Tom Holzer, Ross Stein, David Wald, and an anonymous reviewer for insightful comments.

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Manuscript received 17 Nov. 2012; accepted 7 Jan. 2013

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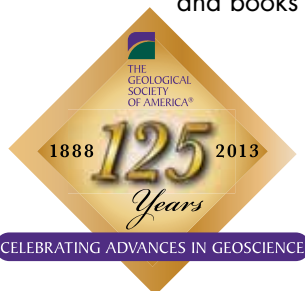
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2013 GSA Section Meetings & Mentor Programs

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U.S. Section Meetings

South-Central • 4–5 April

Austin, Texas, USA

Shlemon Mentors Luncheon:

Thursday, 4 April

Mann Mentors Luncheon:

Friday, 5 April

North-Central • 2–3 May

Kalamazoo, Michigan, USA

Shlemon Mentors Luncheon:

Thursday, 2 May

Mann Mentors Luncheon:

Friday, 3 May

Cordilleran • 20–22 May

Fresno, California, USA

Shlemon Mentors Luncheon:

Monday, 20 May

Mann Mentors Luncheon:

Tuesday, 21 May

Rocky Mountain • 15–17 May

Gunnison, Colorado, USA

Shlemon Mentors Luncheon:

Wednesday, 15 May

Mann Mentors Luncheon:

Thursday, 16 May

International Section Meeting

International Roof of the World 17–19 June

Chengdu, Sichuan Province, China

www.geosociety.org/Sections/meetings.htm

*Roy J. Shlemon Mentor Program in Applied Geology—FREE lunch for undergraduate and graduate students interested in a career in applied geology

**John Mann Mentors in Applied Hydrogeology Program—FREE lunch for undergraduate and graduate students interested in a career in hydrogeology

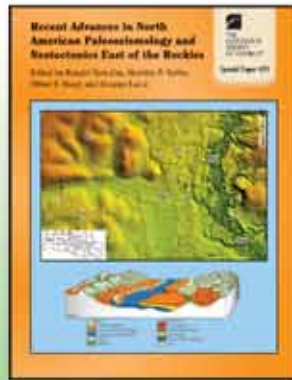
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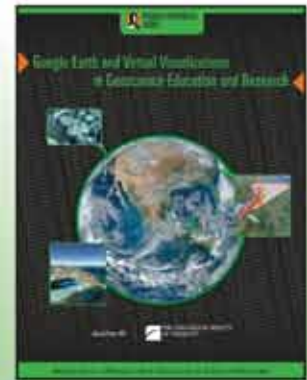
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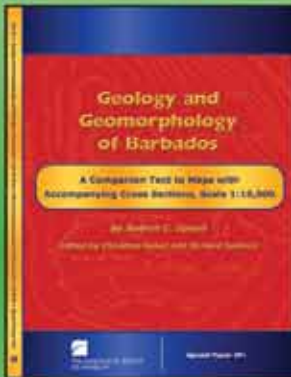
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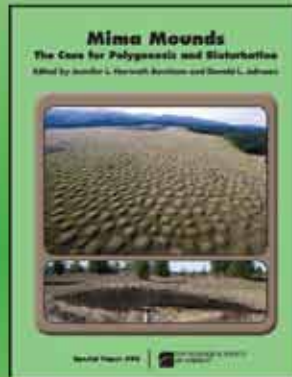
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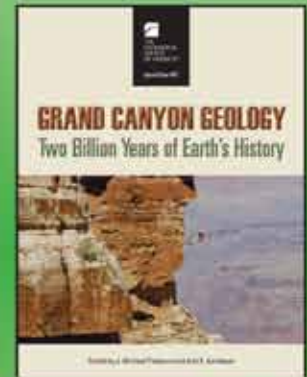
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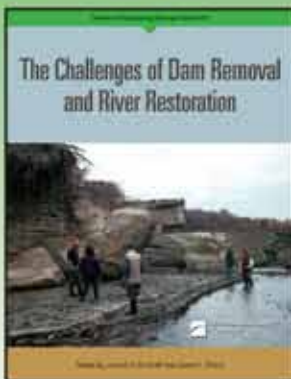


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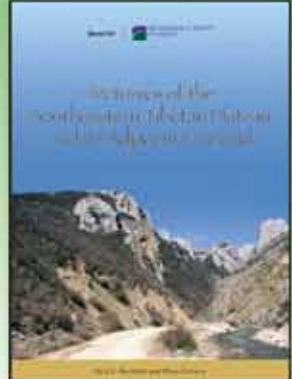
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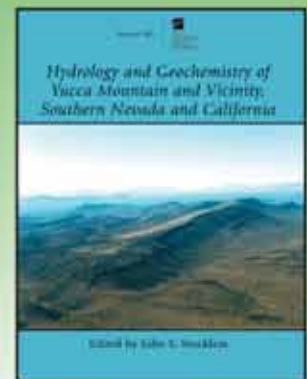
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