

GSA TODAY

A Publication of the Geological Society of America

1999 Annual Meeting & Exposition

Colorado Convention Center
Hyatt Regency Hotel
Marriott City Center Hotel

October 25-28, 1999
Denver, Colorado

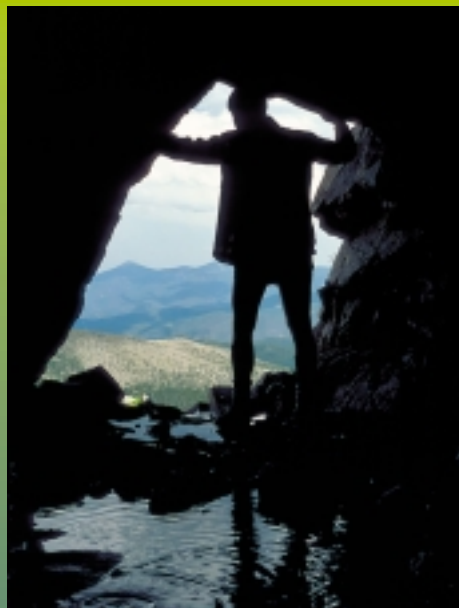


Table of Contents

Abstracts with Programs	32
Convenience Information	26
Employment Service	22
Exhibits	20
Field Trips	13
Graduate School Information Forum	23
Guest Activities	24
Hot Topics at Noon	9
Housing	28
How to Submit Your Abstract	12
Institute for Earth Science and the Environment	22
International Program	6
K-16 Education Program	18
Membership	30
Registration	30
Short Courses	16
Special Events	23
Special Programs	22
Technical Program	3
Travel	25

Crossing Divides

World Wide Web

Visit the GSA Web site to obtain more details and to get the latest information on the Annual Meeting.
www.geosociety.org

Deadlines

Abstracts due July 12
Preregistration and Housing due September 17
(forms enclosed)

For More Information

Call: (303) 447-2020 or 1-800-472-1988
Fax: 303-447-0648
E-mail: meetings@geosociety.org
Web: www.geosociety.org

Cover photos by John A. Karachewski: Large photo shows the Continental Divide—Sawatch Range, Collegiate Peaks Wilderness, Colorado; small photo taken near James Peak, Colorado

The Geological Society of America





Crossing Divides

Welcome to Denver!

The proximity of the 1999 GSA Annual Meeting both in space to the Continental Divide and in time to the end of the 20th century inspired the theme of "Crossing Divides." The intent is to celebrate the cross-disciplinary nature of the geosciences and to encourage a scientific program that crosses divides among the various chemical, biological, and physical disciplines of our science. Our hope is that the program will instill in attendees a broadened sense of the contributions the geological sciences can make as a discipline and the degree to which an individual's research is linked to many other specialties. An exciting set of field trips, controversial Hot Topics, and a diverse group of exhibitors round out the meeting.

Denver has wonderful cultural attractions, museums, dining, and nightlife. Other reasons to come to Denver are that it has 300 days of sunshine per year (more than San Diego or Miami Beach!) and the largest city park system in the country. In addition to its superlative climate and expansive parks, Denver brews more beer than any other American city. What more could a geoscientist want! We encourage you to come to the meeting early or stay late and enjoy the cultural wonders of the city and the natural wonders of the Rocky Mountains. To enhance your visit, we suggest that you find out more about Denver's colorful history, sights and attractions, lodging, and dining, as well as interesting facts about the city at <http://www.denvergov.org>.

You and your guests can explore the many aspects of Denver's colorful historical past through sites such as the Molly Brown House, the State Capitol on Capitol Hill, and nearby Central City, an old mining town that was once referred to as the "richest square mile on Earth."



Annual Meeting Committee

General Co-Chairs: Mary Kraus, David Budd, University of Colorado

Technical Program Co-Chairs: Craig Jones, G. Lang Farmer, University of Colorado

Field Trip Co-Chairs: Alan Lester, Bruce Trudgill, University of Colorado

Student Assistants Co-Chair: Suzanne Larsen, Karl Mueller, University of Colorado

Education Chair: Lisa Barlow, University of Colorado

Hot Topics Co-Chairs: Cathleen May, Geological Society of America, Ruthann Knudson, Agate Fossil Beds National Monument

Annual Meeting Hosts

Colorado Scientific Society

Rocky Mountain Association of Geologists

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GSA thanks the 1999 Annual Meeting Hosts and Sponsors for their generous contributions to help make the Denver meeting a success.

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This publication is included on GSA's annual CD-ROM, *GSA Journals on Compact Disc*. Call GSA Publication Sales for details.

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Pardee Keynote Symposia

Invited Papers

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

These keynote sessions are special events of broad interest to the geoscience community. They represent topics on the leading edge of a scientific discipline or area of public policy, address broad fundamental problems, are interdisciplinary, or focus on global problems. Selection was on a competitive basis. This year's eight Pardee Symposia were reviewed by a panel of Joint Technical Program Committee (JTPC) representatives and accepted by the Annual Program Committee. (All speakers are invited.)

Abstracts Deadline: July 12 Please send all invited abstracts (electronic and paper) to GSA. Abstracts will be forwarded to the conveners for review.

K01 ■ Impact Events: Environmental Consequences and Their Influence on the Origin and Evolution of Life

GSA Planetary Geology Division; Paleontological Society. David A. Kring, Lunar and Planetary Laboratory, University of Arizona, Tucson. *Tuesday, p.m.* ORAL

Largely on the basis of Cretaceous-Tertiary boundary studies, impact cratering is now widely recognized as an important geologic process. This symposium will explore how this type of geologic process can also affect local and regional environments, global climate, and the biologic evolution of Earth.

K02 ■ Human Transformation of the Physical Landscape

GSA Archaeological Geology Division. Lisa E. Wells, Vanderbilt University, Nashville, Tennessee; Patrick Julig, Laurentian University, Sudbury, Ontario. *Thursday, p.m.* ORAL

Agriculture, grazing, mining, deforestation, and urbanism cause profound changes to Earth's topography, geochemistry, soil, and sediment budget. Human activities move more sediment per year than all other processes. Soil erosion impacts both biologic productivity and global climate by changing the carbon cycle, the hydrologic cycle, and eolian dust flux. This symposium will integrate millennial-scale lessons of landscape degradation and conservation into the discussion of modern landscape transformation.

K03 ■ Maintaining a Livable Earth: Conversations Among Concerned Geologists

GSA ad hoc Committee on Critical Issues; Institute for Environmental Education. Jill S. Schneiderman, Vassar College, Poughkeepsie, New York; Susan W. Kieffer, Kieffer Institute for Science-Based Education, Palgrave, Ontario. *Monday, a.m.* ORAL

Selected authors of essays for a book for the general public concerning the relevance of geology to environmental decisions will present brief narratives demonstrating that without geological knowledge, solutions to environmental problems will not be forthcoming. The symposium will be an interactive session involving extensive discussion with audience members.

K04 ■ Geoscientists in the Legal System: The Challenge for the Next Century

GSA Hydrogeology Division; National Ground Water Association. E. Scott Bair, Ohio State University, Columbus; Steve Wheatcraft, University of Nevada, Reno; David Stephenson, S.S. Papadopoulos & Associates, Jackson, Wyoming. *Tuesday, a.m.* ORAL

Keynote speaker Jonathan Harr will describe his observations on the effectiveness of the scientific testimony presented at the Woburn Toxics Trial. A judge, attorneys, and expert geoscience witnesses will present their opinions on the role of science in our legal system and how to be an effective and ethical expert

witness. A panel discussion and a question and answer period will conclude the session.

K05 ■ Low-Latitude Precambrian Glaciation: Geochemical, Climatic, and Biological Effects of the Snowball Earth

Joseph L. Kirschvink, California Institute of Technology, Pasadena; Paul F. Hoffman, Harvard University, Cambridge, Massachusetts. *Wednesday, p.m.* ORAL

Precambrian glacial deposits have long been recognized as peculiar, because of climatic indicators indicating sea-level ice within the tropics. This symposium will explore geological, geophysical, climatic, and geochemical constraints on these putative low-latitude glaciations, and some of the biological implications of "Snowball Earth" conditions produced when the oceans freeze over completely.

K06 ■ Globally Warm Climates of the Early Cenozoic: Evidence, Causes, and Biotic Consequences

Paleontological Society. Scott L. Wing, Smithsonian Institution, Washington, D.C.; Lisa C. Sloan, University of California, Santa Cruz. *Monday, p.m.* ORAL

Globally warm climates are an enduring geological enigma, pitting our understanding of the processes that generate climate against our interpretation of past conditions based on geological, paleontological, and geochemical data. Speakers in this symposium will discuss recent research that illuminates the possible causes and biotic effects of globally warm climates in the early Cenozoic.

K07 ■ The Case for Steady-State Mountain Belts: Observations, Models, and Implications for Global Tectonics

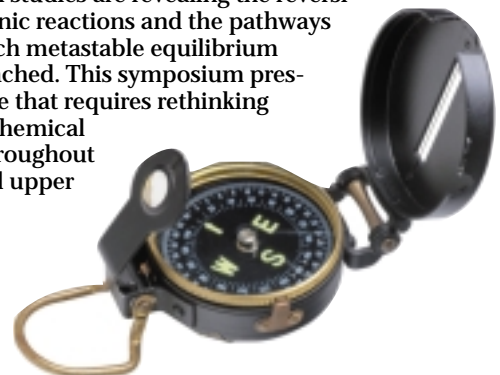
GSA Quaternary Geology and Geomorphology Division. Peter L. Knuepfer, Binghamton University, Binghamton, New York; Frank J. Pazzaglia, University of New Mexico, Albuquerque. *Wednesday, a.m.* ORAL

It has been suggested that the dynamic and demonstrated interaction between tectonics and topography leads to a "steady-state" mountain range, but what defines steady-state conditions and under what circumstances can they truly be attained? This symposium will focus on reconciling field and model-based studies in defining orogenic steady state. We hope to provide insights of diverse tectonic expressions of topography and the role that steady-state processes play in their origin.

K08 ■ New Insights on Organic Metamorphism in the Earth

Group Exploring Organic Processes In Geochemistry. Everett L. Shock, Washington University, St. Louis, Missouri; Harold C. Helgeson, University of California, Berkeley. *Thursday, a.m.* ORAL

Organic compounds persist at much higher temperatures and pressures than generally thought. Analytical, theoretical, and experimental studies are revealing the reversibility of organic reactions and the pathways through which metastable equilibrium states are reached. This symposium presents evidence that requires rethinking organic geochemical processes throughout the crust and upper mantle.



Discipline and Topical Sessions

Invited and Volunteered Papers

Discipline Sessions

Papers are submitted to ONE scientific discipline. The Joint Technical Program Committee (JTPC) representatives organize the papers in sessions focused on this discipline—for example, environmental geoscience or mineralogy.

Topical Sessions

These sessions are topically focused with a mix of invited and volunteered papers. The sessions are designed to promote the exchange of interdisciplinary, state-of-the-art information. Papers are submitted to a specific session title and to ONE scientific discipline. Each topical session may have as many as three disciplines from which authors may choose ONE. After each topical description below, the disciplines are identified by name and number as they appear on the 1999 Abstract Form. PLEASE SUBMIT ONLY IN THE MODE (oral or poster) AND DISCIPLINES INDICATED in the description. An abstract submitted in the incorrect mode will be transferred automatically to a discipline session.

Abstracts Deadline: July 12 Please send all invited and volunteered abstracts (electronic and paper) to GSA. Abstracts will be forwarded to the advocates for review.

ROLE OF SESSION ADVOCATE. An advocate has proposed each topical session. Advocates may invite specific papers to ensure a successful and excellent session. Volunteered abstracts are also solicited for all approved topical sessions unless otherwise indicated. JTPC representatives, in consultation with the advocates, will organize topical sessions by early August.

T01 ■ **Origins of Carbonate Mounds: Crossing the Divides of Sedimentology, Diagenesis, and Paleontology**

GSA Sedimentary Geology Division. David C. Kopaska-Merkel, Geological Survey of Alabama, Tuscaloosa; Douglas W. Haywick, University of South Alabama, Mobile. ORAL and POSTER

Sediments, Carbonate [27], Paleontology/Paleobotany [18]

T02 ■ **Geochemical and Isotopic Tracers Applied to Sedimentary Provenance, Drainage Systems, and Related Tectonics**

GSA Sedimentary Geology Division. Jonathan Patchett, University of Arizona, Tucson; Chris Holmden, University of Saskatchewan, Saskatoon. ORAL and POSTER

Sediments, Clastic [28], Geochemistry, Other [7], Geochemistry, Aqueous [6]

T03 ■ **Alloformations, Synthems, and Sequences**

GSA Sedimentary Geology Division. Ernest A. Mancini, University of Alabama, Tuscaloosa; Lucy E. Edwards, Reston, Virginia; Burleigh Harris, University of North Carolina at Wilmington. ORAL

Stratigraphy [29], Sediments, Clastic [28], Sediments, Carbonate [27]

T04 ■ **Applied Integrated Stratigraphy in Exploration and Development Geology: New Techniques and Perspectives**

Cushman Foundation, GSA Sedimentary Geology Division.

Eduardo A. Koutsoukos, PETROBRAS, Rio de Janeiro, Brazil. ORAL

Stratigraphy [29], Geoscience Information [11], Economic Geology [3]

T05 ■ **Effects of Impact Events in the Sedimentary Record**

GSA Planetary Geology Division; GSA Sedimentary Geology Division; European Science Foundation (ESF) Impact Program.

Watch for This Face at the 1999

Annual Meeting in Denver



Photo by Paul Abdoo

This is Sara Foland, GSA's new Executive Director/CEO effective June 30, 1999.

Sara Foland assumes leadership of GSA when Don Davidson, executive director since 1994, retires at the end of June.

Foland comes to GSA from Farallon Energy Group Ltd. in Denver. As CEO and president of Farallon, she designed the company and built an investment portfolio for acquisition of gas-producing properties throughout the United States. For 16 years prior to joining Farallon, she held leadership and geotechnical positions at Amoco Production Company in Denver. She is also an active leader on the boards of several not-for-profit organizations.

A GSA member since 1983, Foland earned Bachelor of Science degrees in geology and chemistry and an Executive MBA from Indiana University. She holds an M.S. in geology from the University

of Montana, and will complete a Ph.D. in tectonics at the University of California-Santa Cruz in the next year. Her dissertation is entitled, "The Structural Evolution of the Northern Terminus of the San Andreas Fault System, Offshore Point Arena Basin."

"GSA has a tradition of excellence that we will continue to honor while working toward the vision outlined in GSA's Strategic Plan," Foland told the Council and staff after accepting the appointment. You can read more about her plans for GSA in the August issue of *GSA Today*.

Details on where you can meet Sara Foland will be announced at the Annual Meeting and will be posted on the GSA Web site (www.geosociety.org) as they become available.

Watch for an interview with retiring Executive Director Don Davidson in the July issue of *GSA Today*.

Christian Koeberl, University of Vienna, Austria; Philippe Claeys, Museum of Natural History, Berlin, Germany. ORAL

Stratigraphy [29], Planetary Geology [22], Geochemistry, Other [7]

T06 ■ Faulting and Folding: Crossing the Divide Between 2-D and 3-D

GSA Structural Geology and Tectonics Division. M. Scott Wilkerson, DePauw University, Greencastle, Indiana; John O. Byrd, Paradigm Geophysical, Inc., Houston, Texas. ORAL and POSTER

Structural Geology [30], Tectonics [31]

T07 ■ Dates of Faults and Rates of Deformation

GSA Structural Geology and Tectonics Division. Rasoul B. Sorkhabi, Japan National Oil Corporation, Chiba 261-0025, Japan; Ramon Arrowsmith, Arizona State University, Tempe. ORAL

Structural Geology [30], Geophysics/Tectonophysics [10], Quaternary Geology/Geomorphology [25]

T08 ■ Active Faulting and Earthquake Behavior in Complex Orogens: A Multidisciplinary Approach

GSA Structural Geology and Tectonics Division. Karl J. Mueller, University of Colorado, Boulder; John H. Shaw, Harvard University, Cambridge, Massachusetts. ORAL and POSTER

Tectonics [31]

T09 ■ Origin of Orogenic Plateaus: Interactions of Plate Convergence, Mantle Processes, and Surficial Processes in Continental Tectonics

Karl E. Karlstrom, Frank J. Pazzaglia, Mousumi Roy, University of New Mexico, Albuquerque. ORAL and POSTER

Tectonics [31], Geophysics/Tectonophysics [10], Structural Geology [30]

T10 ■ Cenozoic Tectonics of the Southern Rocky Mountains in Colorado and New Mexico: Connections with Global Processes

GSA Geophysics Division; GSA Structural Geology and Tectonics Division. Eric A. Erslev, Colorado State University, Fort Collins; G. Randy Keller, University of Texas at El Paso; Anne Sheehan, University of Colorado, Boulder. ORAL

Geophysics/Tectonophysics [10], Structural Geology [30], Quaternary Geology/Geomorphology [25]

T11 ■ Making Crustal Souffles: High Mountains and Thin Crust in the Sierra Nevada

Stephen K. Park, University of California, Riverside. ORAL

Geophysics/Tectonophysics [10], Tectonics [31], Quaternary Geology/Geomorphology [25]

T12 ■ The International Space Station: New Opportunities for Earth Science Research and Education

Cynthia A. Evans, NASA-Johnson Space Center/LMESS, Houston, Texas; Dean B. Eppler; Patricia W. Dickerson, NASA-Johnson Space Center/SAIC, Houston, Texas. ORAL and POSTER

Remote Sensing/Geographic Information Systems [26], Geology Education [8], Planetary Geology [22]

T13 ■ Mars, The Next Generation: The Emergent, New Geology of Earth's Neighboring World

GSA Planetary Geology Division. Kenneth S. Edgett, Malin Space Science Systems, Inc., San Diego, California; James W. Rice, Jr., University of Arizona, Tucson. ORAL

Planetary Geology [22], Quaternary Geology/Geomorphology [25], Remote Sensing/Geographic Information Systems [26]

Precambrian gneiss/migmatite, Highway 92, Black Canyon of the Gunnison National Monument, Colorado—Photo by John A. Karachewski



T14 ■ Morphological and Mineralogical Biomarkers for Mars Exploration

GSA Planetary Geology Division; Astrobiology Program of National Aeronautics and Space Administration. John F. Kerridge, University of California, San Diego; J. William Schopf, University of California, Los Angeles; Gene D. McDonald, Jet Propulsion Laboratory, Pasadena, California. ORAL

Planetary Geology [22], Paleontology/Paleobotany [18], Mineralogy/Crystallography [16]

T15 ■ Beryllium: Mineralogy, Petrology, and Geochemistry

Mineralogical Society of America. Edward S. Grew, University of Maine, Orono. ORAL

Mineralogy/Crystallography [16], Geochemistry, Other [7], Petrology, Experimental [19]

T16 ■ Uranium: Minerals, Chemistry, and the Environment

Mineralogical Society of America. Peter C. Burns, University of Notre Dame, Notre Dame, Indiana; Robert J. Finch, Argonne National Laboratory, Argonne, Illinois. ORAL and POSTER

Mineralogy/Crystallography [16], Geochemistry, Other [7], Environmental Geoscience [5]

T17 ■ New Insights into the Giant Butte Hydrothermal Deposit

Mark H. Reed, University of Oregon, Eugene; John H. Dilles, Oregon State University, Eugene. ORAL

Economic Geology [3], Geochemistry, Other [7], Structural Geology [30]

T18 ■ Application of Advanced Geochemical Modeling to Mining-Related Environmental Issues

Geochemical Society; Mineralogical Society of America. Chen Zhu, Old Dominion University, Norfolk, Virginia; Richard K. Preece, BH Copper, Inc., Tucson, Arizona; David Burden, Robert S. Kerr, Environmental Research Laboratory, Ada, Oklahoma. ORAL

Environmental Geoscience [5], Geochemistry, Aqueous [6], Hydrogeology [13]

Discipline and Topical Sessions

T19 ■ Energy Mix of the Future: Meeting the Needs of Society and a Changing Environment

Peter D. Warwick, Allan Kolker, Energy Resources Program, Reston, Virginia; Michele L. Tuttle, Energy Resources Program, Denver, Colorado. ORAL

Environmental Geoscience [5], Public Policy [24], Coal Geology [2]

T20 ■ Geology: The Bedrock of the Ecosystem: Biological Uses of Geologic Data

Bruce A. Heise, National Park Service, Lakewood, Colorado. ORAL

Environmental Geoscience [5], Non-geoscience [33]

T21 ■ New Advances in Mine Site Remediation and Reclamation: Taking a Landscape Perspective

GSA Engineering Geology Division. Anne MacDonald, Exponent, Inc., Boulder, Colorado. ORAL

Engineering Geology [4], Environmental Geoscience [5], Quaternary Geology/Geomorphology [25]

T22 ■ Dam Geology: New Science Applied to Old Problems

GSA Engineering Geology Division; Association of Engineering Geology. Robert A. Larson, Los Angeles County Department of Public Works, Van Nuys, California; Kerry D. Cato, Raytheon Infrastructure, Temecula, California. ORAL

Engineering Geology [4], Quaternary Geology/Geomorphology [25], Public Policy [24]

T23 ■ De-icing Salts and Their Effect on Crushed Rock Aggregate

GSA Engineering Geology Division. Peter P. Hudec, School of Physical Sciences, Windsor, Ontario; Robert A. Larson, Van Nuys, California. ORAL

Engineering Geology [4], Economic Geology [3]

T24 ■ Digital Field Mapping and Data Collection

GSA Engineering Geology Division; GSA Structural Geology and Tectonics Division. John H. Kramer, Sonora, California. ORAL

Engineering Geology [4], Economic Geology [3], History of Geology [12]

T25 ■ Engineering and Environmental Geology: State Geological Surveys and Academic Committees

GSA Engineering Geology Division. Duane A. Eversoll, University of Nebraska, Lincoln; Robert A. Larson, Department of Public Works, Van Nuys, California. ORAL

Engineering Geology [4], Environmental Geoscience [5], Public Policy [24]

T26 ■ Expansive Materials Along the Front Range of Colorado: Identification, Clay Mineralogy, Mapping Programs, and a Depth of Wetting Resulting from Development

GSA Engineering Geology Division; Association of Engineering Geologists. Edward O. Church, Wheat Ridge, Colorado. ORAL

Engineering Geology [4]

T27 ■ Geologic Input to Public Decision-Making: The Need for Greater Predictive Capability

GSA Engineering Geology Division; Institute for Environmental Education. Jerome V. DeGraff, Clovis, California. ORAL

Engineering Geology [4], Environmental Geoscience [5], Hydrogeology [13]

T28 ■ Geologic Hazard Mapping: The State of the Art

GSA Engineering Geology Division; Association of Engineering Geologists. Randall W. Jibson; Edwin L. Harp, U.S. Geological Survey, Golden, Colorado. ORAL

Engineering Geology [4], Public Policy [24], Remote Sensing/Geographic Information Systems [26]

T29 ■ Reactivation of Old Landslides Following Development

GSA Engineering Geology Division; Quaternary Geology and Geomorphology Division. Scott F. Burns, Portland State University, Portland, Oregon; Robert A. Larson, Los Angeles County Department of Public Works, Van Nuys, California. ORAL

Engineering Geology [4], Quaternary Geology/Geomorphology [25]

T30 ■ Coastal Geologic Risk: Mapping the Hazards and Influencing Public Policy

David M. Bush, State University of West Georgia, Carrollton; Robert S. Young, Western Carolina University, Cullowhee, North Carolina. ORAL

Marine/Coastal Science [14], Environmental Geoscience [5], Public Policy [24]

T31 ■ Communication Divides: Perspectives on Supporting Information Bridges in the Geosciences

Geoscience Information Society. Lois Heiser, Indiana University, Bloomington; Charlotte M. Derksen, Stanford University, Stanford, California. ORAL

Geoscience Information [11], History of Geology [12], Geology Education [8]

T32 ■ Geoscience Ethics Guidelines: A Discussion of Their Development, Utility, and Implementation

David M. Abbott, AIPG Ethics Committee, Denver, Colorado; Jonathan G. Price, University of Nevada, Reno. ORAL

Non-geoscience [33], Public Policy [24], Geology Education [8]

T33 ■ Crossing the Greatest Divide: The Earth Sciences, the Humanities, and the Needs of Society

Robert L. Frodeman, University of Tennessee, Chattanooga; Eldridge M. Moores, University of California, Davis. ORAL

Public Policy [24], History of Geology [12], Non-geoscience [33]

T34 ■ Mission-Driven Geology: Meeting Global Challenges and Society's Needs

M. Lee Allison, Utah Geological Survey, Salt Lake City. POSTER

Public Policy [24], Non-geoscience [33]

International Survey Program

International membership in GSA is growing faster than any other segment. GSA is becoming a critical link in fostering geological cooperation through a truly global exchange. As part of this commitment, GSA's International Survey Program (ISP) is bringing together geologists from international geological surveys for the 1999 Denver meeting. Technical papers and exhibits will focus on new geological and environmental developments, opportunities, and challenges across the globe.

Contacts: Lee Allison, Utah Geological Survey, PO Box 146100, Salt Lake City, Utah 84114-6100, USA, (801) 537-3301, Fax 801-537-3400, nrugs.lallison@state.ut.us; or Blyth Robertson, Geological Survey of Canada, 601 Booth St., Ottawa, Ontario, K1A 0E8, Canada, (613) 996-4239, blrobert@nrcan.gc.ca.

After July 15: Lee Allison, Kansas Geological Survey, 1930 Constant Avenue, University of Kansas, Lawrence, KS 66047, (785) 864-3965, Fax 785-864-5317

T35 ■ Environmental Justice: Geoecological, Social, and Philosophical Perspectives

Paul Pinet, Colgate University, Hamilton, New York; Paul Reitan, University of New York at Buffalo; Trileigh Stroh, Seattle University, Seattle, Washington. ORAL

Public Policy [24], Geology Education [8]

T36 ■ Preserving Data in the Public Trust: Stewardship of the Record of Past Climates

GSA Quaternary Geology and Geomorphology Division; Institute for Environmental Education; GSA Archaeological Geology Division; National Park Service. Ruthann Knudson, Agate Fossil Beds National Monument, Harrison, Nebraska. ORAL

Public Policy [24], Quaternary Geology/Geomorphology [25], Paleoceanography/Paleoclimatology [17]

T37 ■ Crossing Disciplinary Boundaries in the Geosciences: Historical Perspectives

GSA History of Geology Division; History of the Earth Sciences Society [HESS]. Kenneth L. Taylor, University of Oklahoma, Norman; Michele L. Aldrich, Cornell University, Ithaca, New York. ORAL

History of Geology [12], Tectonics [31], Paleoceanography/Paleoclimatology [17]

T38 ■ Monsoons, Tectonics, and Climate Change

GSA Quaternary Geology and Geomorphology Division. David M. Anderson, Bowdoin College, Brunswick, Maine; DeMenocal, Palisades, New York. ORAL

Paleoceanography/Paleoclimatology [17], Tectonics [31], Quaternary Geology/Geomorphology [25]

CANCELLED

T39 ■ Proterozoic Glaciations, Cap Carbonates and Isotopic Excursions: Testing the Snowball Earth Hypothesis

Paul F. Hoffman, Harvard University, Cambridge, Massachusetts; Joseph L. Kirschvink, California Institute of Technology, Pasadena. POSTER

Paleoceanography/Paleoclimatology [17], Precambrian Geology [23], Geochemistry, Aqueous [6]

T40 ■ The Tropics Compared: Icehouse and Greenhouse States

Claudia C. Johnson, Indiana University, Bloomington. ORAL

Paleoceanography/Paleoclimatology [17], Paleontology/Paleobotany [18], Sediments, Carbonate [27]

T41 ■ From Greenhouse to Icehouse: The Marine Eocene-Oligocene Transition

Donald R. Prothero, Occidental College, Los Angeles, California; Linda Ivany, University of Michigan, Ann Arbor; Elizabeth Nesbitt, University of Washington, Seattle. ORAL

Paleontology/Paleobotany [18], Paleoceanography/Paleoclimatology [17], Stratigraphy [29]

T42 ■ A Multidisciplinary Study of Coalbed Methane in the Ferron Coals, Utah: An Unusual Resource with Potential for Global Environmental Impact

GSA Coal Geology Division. Charles E. Barker; Timothy Collett, U.S. Geological Survey, Denver, Colorado. ORAL and POSTER

Coal Geology [2], Environmental Geoscience [5], Geochemistry, Other [7]

T43 ■ The Hell Creek Formation and the Cretaceous-Tertiary Boundary in the Northern Great Plains: An Integrated Continental Record of the End of the Cretaceous

Paleontological Society. Joseph H. Hartman, University of North Dakota, Grand Forks; Kirk R. Johnson, Denver Museum of Natural



Sand dunes and Sangre de Cristo Mountains, Great Sand Dunes National Monument, Colorado—Photo by John A. Karachewski

History, Denver, Colorado; Douglas J. Nichols, U.S. Geological Survey, Denver, Colorado. ORAL

Paleontology/Paleobotany [18], Stratigraphy [29], Sediments, Clastic [28]

T44 ■ High-Resolution Stratigraphic Approaches in Paleontology

Paleontological Society. Dana Geary, University of Wisconsin—Madison; Peter J. Harries, University of South Florida, Tampa. ORAL

Paleontology/Paleobotany [18], Stratigraphy [29], Micropaleontology [15]

T45 ■ Beyond Phylogeny Reconstruction: Tree-Based Analyses in Paleontology

Paleontological Society. Lisa E. Park, University of Akron, Akron, Ohio; Andrew Smith, Natural History Museum, London, UK. ORAL

Paleontology/Paleobotany [18], Micropaleontology [15], Paleoceanography/Paleoclimatology [17]

T46 ■ Fire and Geology: Surface Processes and Stratigraphic Records

GSA Quaternary Geology and Geomorphology Division. Mark A. Gonzalez, University of Denver, Colorado; Grant Meyer, Middlebury College, Middlebury, Vermont; John A. Moody, National Research Program, Lakewood, Colorado. ORAL and POSTER

Quaternary Geology/Geomorphology [25], Paleoceanography/Paleoclimatology [17], Environmental Geoscience [5]

T47 ■ Geomorphic and Ecological Responses to Natural and Anthropogenic Disturbances

GSA Quaternary Geology and Geomorphology Division. Jerry R. Miller, Indiana University—Purdue University, Indianapolis; Dru Germanoski, Lafayette College, Easton, Pennsylvania. ORAL

Quaternary Geology/Geomorphology [25], Environmental Geoscience [5], Non-geoscience [33]

T48 ■ Integrated Landscapes: The Colorado Front Range

GSA Quaternary Geology and Geomorphology Division. Ellen E. Wohl, Colorado State University, Fort Collins. ORAL

Quaternary Geology/Geomorphology [25], Environmental Geoscience [5]

T49 ■ Glaciation and Reorganization of Asia's Network of Drainage: The Effects on Late Quaternary Global Change

GSA Quaternary Geology and Geomorphology Division; International Geological Correlation Program (IGCP). Lewis A. Owen, University of California, Riverside; Jim Teller, University of Manitoba, Winnipeg; Nat Rutter, University of Alberta, Edmonton. ORAL

Quaternary Geology/Geomorphology [25], Paleoceanography/Paleoclimatology [17], Stratigraphy [29]

T50 ■ North Atlantic Crossroads: Terrestrial and Marine Environmental Records of Iceland

GSA Quaternary Geology and Geomorphology Division. John T. Andrews, University of Colorado, Boulder. ORAL

Quaternary Geology/Geomorphology [25], Paleoceanography/Paleoclimatology [17], Marine/Coastal Science [14]

T51 ■ Landscape Erosion and Sedimentation Modeling

GSA Sedimentary Geology Division. Russell S. Harmon, Engineering and Environmental Sciences Division, Research Triangle Park, North Carolina; William W. Doe, Colorado State University, Fort Collins. ORAL

Quaternary Geology/Geomorphology [25], Hydrogeology [13], Sediments, Clastic [28]

T52 ■ Geologic and Biologic Evidence for Late Cenozoic Drainage Rearrangements in North America: Implications for Aquatic Biogeography

GSA Quaternary Geology and Geomorphology Division; Smithsonian Institution. Robert Hershler, National Museum of Natural History, Washington, D.C.; Marith C. Reheis, U.S. Geological Survey, Denver, Colorado. ORAL

Quaternary Geology/Geomorphology [25], Non-geoscience [33], Paleontology/Paleobotany [18]



Descending talus blocks into Upper Basin, Holy Cross Wilderness, Colorado—
Photo by John A. Karachewski

T53 ■ Shallow Subsurface Mapping: Using Geophysics for Geological, Groundwater Resource, and Contamination Studies

GSA Quaternary Geology and Geomorphology Division; GSA Geophysics Division, GSA Hydrogeology Division. Susan E. Pullan, Geological Survey of Canada, Ottawa, Ontario; Peter Haeni, U.S. Geological Survey, Storrs-Mansfield, Connecticut. ORAL and POSTER

Quaternary Geology/Geomorphology [25], Geophysics/Tectonophysics [10], Hydrogeology [13]

T54 ■ Subglacial Processes and the Behavior of Ice Sheets

GSA Quaternary Geology and Geomorphology Division. Edward B. Evenson, Lehigh University, Bethlehem, Pennsylvania; Richard B. Alley, Pennsylvania State University, University Park; Daniel Lawson, Cold Regions Research and Engineering Laboratory, Fort Richardson, Arkansas. ORAL

Quaternary Geology/Geomorphology [25], Hydrogeology [13]

T55 ■ Surficial Three-Dimensional Geologic Mapping: Basic Map Products and Applications

GSA Quaternary Geology and Geomorphology Division; Association of American State Geologists and U.S. Geological Survey National Cooperative Geologic Mapping Program. Richard C. Berg, Champaign, Illinois; Peter T. Lyttle, Reston, Virginia. POSTER

Quaternary Geology/Geomorphology [25], Environmental Geoscience [5], Geoscience Information [11]

T56 ■ The Case for Steady-State Mountain Belts: Observations, Models, and Implications for Global Tectonics

GSA Quaternary Geology and Geomorphology Division. Frank J. Pazzaglia, University of New Mexico, Albuquerque; Peter L. Knuepfer, Binghamton University, Binghamton, New York. POSTER

Quaternary Geology/Geomorphology [25], Tectonics [31], Geophysics/Tectonophysics [10]

T57 ■ Granite Systems and Proterozoic Lithospheric Processes

William R. Van Schmus, University of Kansas, Lawrence; Carol D. Frost, University of Wyoming, Laramie. ORAL and POSTER

Precambrian Geology [23], Petrology, Igneous [20], Tectonics [31]

T58 ■ Role of Supercontinents in Earth History: Assembly and Dispersal of the Rodinian Supercontinent (1300–750 Ma), and Impacts on Evolution of the Proterozoic Biosphere, Hydrosphere, and Crust-Mantle System

GSA Structural Geology and Tectonics Division. Christopher M. Powell, University of Western Australia, Nedlands; Richard E. Hanson, Texas Christian University, Fort Worth. ORAL

Precambrian Geology [23], Tectonics [31]

T59 ■ Multidisciplinary Studies in Volcanology, Planetary Geology, and Economic Geology: A Tribute to 50 Years of Research by Professor Wolfgang Elston, University of New Mexico

Eugene I. Smith, University of Nevada, Las Vegas; James G. Aldrich, Los Alamos National Laboratory, Los Alamos, New Mexico. ORAL and POSTER

Volcanology [32], Planetary Geology [22], Economic Geology [3]

Hot Topics at Noon

HOT
Debates



HOT
Lunch

12:15 to 1:15 p.m.,
Colorado Convention Center

■ **Green Accounting in the Marketplace: Calculating the Value of Natural Resources**

Can the value of ecosystem processes be measured and expressed in dollars? Can this approach aid in cost-benefit analyses of competing land and resource uses? *Monday, October 25*

■ **Credibility for Sale: Ethics and the Expert Witness**

What happens to our credibility if we are being paid to discover evidence for a client? On the other hand, is it ethical to withhold expertise to preserve the myth of "objective" science? *Tuesday, October 26*

■ **Climates Change, Get With It!**

We know that climates vary through time; the question is whether human behavior can alter natural variability. What is the nature of the evidence regarding human impacts on climate? *Wednesday, October 27*

■ **Earth Systems Science: Gaia as Goddess of Insight or Siren of Doom?**

Some say that systemic approaches to understanding Earth will yield useful new insights. Others claim that this trend is nothing more than "New Age Environmentalism" in disguise. *Thursday, October 28*

T60 ■ Building the Quantitative Skills of Nonmajors and Majors in Geoscience Courses

National Association of Geoscience Teachers. R. Heather Macdonald, College of William and Mary, Williamsburg, Virginia; LeeAnn Srogi, West Chester University, West Chester, Pennsylvania; Glenn B. Stracher, East Georgia College, Swainsboro. ORAL and POSTER
Geology Education [8]

T61 ■ Undergraduate Research: Strategies for Success

National Association of Geoscience Teachers; Council on Undergraduate Research, Keck Geology Consortium. Jill K. Singer, Buffalo State College, Buffalo, New York; Virginia Peterson, Western Carolina University, Cullowhee, North Carolina; Robert Shuster, University of Nebraska at Omaha. ORAL
Geology Education [8]

T62 ■ Student Research

Sigma Gamma Epsilon. James C. Walters, University of Northern Iowa, Cedar Falls; Charles J. Mankin, Oklahoma Geological Survey, Norman. POSTER
Geology Education [8]

T63 ■ Linking Science Research and Education to Improve Undergraduate Geoscience Programs and K-12 Earth Science Teacher Preparation

Frank M. Ireton, American Geophysical Union, Washington, D.C.; Stephanie A. Stockman, Laboratory for Terrestrial Physics, Geodynamics Branch, Greenbelt, Maryland; Edward E. Geary, Geological Society of America, Boulder, Colorado. POSTER
Geology Education [8]

T64 ■ Tectonics, Topography, and Climate: The State of the Art in Earth Systems Science Teaching and Research

National Association of Geoscience Teachers. Jeff Niemitz, Dickinson College, Carlisle, Pennsylvania; Yildirim Dilek, Miami University, Oxford, Ohio. ORAL
Geology Education [8], Tectonics [31], Paleooceanography/Paleoclimatology [17]

T65 ■ Evaluation and Assessment of Multimedia Computer-Assisted Geoscience Education: A Hard Look at What Works and Why

Michael M. Kelly, Northern Arizona University, Flagstaff. ORAL
Geology Education [8], Geoscience Information [11], Environmental Geoscience [5]

T66 ■ Successes in Creating Multimedia-Assisted Learning Environments: The Sage on the Stage Versus the Guide on the Side—Yet Another Divide to Cross

National Association of Geoscience Teachers; American Geological Institute. John C. Butler, University of Houston, Houston, Texas; Warren Huff, University of Cincinnati, Cincinnati, Ohio; Michelle Lamberson, University of British Columbia, Vancouver. ORAL
Geology Education [8]

T67 ■ Teaching Science by Example: Real Problems, Real Data, All Classes, Every Day

National Association of Geoscience Teachers. Paul Howell, University of Kentucky, Lexington. POSTER
Geology Education [8]

T68 ■ Successful Assessment Case Studies of Common Concerns in the Geoscience Classroom

National Association of Geoscience Teachers. Dean A. McManus, University of Washington, Seattle; William Prothero, University of California, Santa Barbara. ORAL
Geology Education [8]

T69 ■ People and Landscapes: Earth Systems Interpretation in Park Areas

James F. Wood, National Park Service, Lakewood, Colorado; Allyson C. Mathis, National Park Service, Capulin, New Mexico. ORAL
Geology Education [8]

T70 ■ Teaching Earth Science with Art

Gary D. Rosenberg, Indiana University—Purdue University, Indianapolis; Richard Leo, Cerro Coso Community College, Ridgecrest, California. ORAL
Geology Education [8], History of Geology [12]

T71 ■ Teaching Geologic Time: Methods and Relevance

National Association of Geoscience Teachers. Martin Miller, University of Oregon, Eugene. ORAL
Geology Education [8]

T72 ■ Teaching Geology to the Disabled

National Association of Geoscience Teachers. Pranoti M. Asher, Georgia Southern University, Statesboro. POSTER
Geology Education [8]

T73 ■ The Significance of the National Academy of Sciences—National Research Council's National Science Education Standards to the Public Understanding and Future of the Geosciences

National Association of Geoscience Teachers. Bonnie J. Brunkhorst, California State University, San Bernardino; Edward E. Geary, Geological Society of America, Boulder, Colorado; Ramon E. Lopez, University of Maryland, College Park. ORAL
Geology Education [8]



Alpenglow on arete of Precambrian gneiss, cirque at head of Mayflower Gulch, Tenmile Range, Colorado—Photo by John A. Karachewski

T74 ■ Isotopic Records of Microbially Mediated Processes in Natural Environments

Geochemical Society. Chuanlun Zhang; Timothy W. Lyons, University of Missouri–Columbia; Christopher S. Romanek, Savannah River Site, Aiken, South Carolina. ORAL and POSTER

Geochemistry, Other [7], Geomicrobiology [9], Geochemistry, Aqueous [6]

T75 ■ Geomicrobiology and Biogeochemistry

Geochemical Society. Katrina J. Edwards, University of Wisconsin–Madison; Dianne Newman, Harvard Medical School, Boston, Massachusetts. ORAL and POSTER

Geochemistry, Other [7], Geomicrobiology [9], Environmental Geoscience [5]

T76 ■ Global Biogeochemical Cycles and Climate

William W. Hay, Christian-Albrechts-University, Kiel, Germany. ORAL

Geochemistry, Other [7], Paleoclimatology/Paleogeography [17]

T77 ■ The Geology of Geomicrobiology: The Links Between Mineralogy and Microbial Ecology

GSA Hydrogeology Division. Philip C. Bennett, University of Texas at Austin; Franz Hiebert, RMT, Inc., Austin, Texas. ORAL

Hydrogeology [13], Geochemistry, Aqueous [6], Geomicrobiology [9]

T78 ■ Calibration, Inversion, and Uncertainty of Groundwater Models

GSA Hydrogeology Division; International Ground Water Modeling Center, Colorado School of Mines; U.S. Geological Survey, Denver. Eileen P. Poeter, Colorado School of Mines, Golden; Mary C. Hill, U.S. Geological Survey, Boulder, Colorado. ORAL

Hydrogeology [13], Environmental Geoscience [5]

T79 ■ Dynamics of Mass Transport in Fractured Rock and Glacigenic Sediment: Contributions from Laboratory and Field Analyses to Conceptual and Mathematical Modeling

GSA Hydrogeology Division. Peter R. Jorgensen, University of Copenhagen, Copenhagen, Denmark; William W. Simpkins, Iowa State University, Ames. ORAL

Hydrogeology [13], Environmental Geoscience [5]

T80 ■ Measurement and Description of Flow and Transport in Highly Heterogeneous Aquifers

GSA Hydrogeology Division. Hongbin Zhan, Texas A&M University, College Station; David A. Benson, University of Nevada, Reno. ORAL

Hydrogeology [13], Environmental Geoscience [5], Engineering Geology [4]

T81 ■ Investigations into the Effect of Measurement Scale on Determining Hydraulic Conductivity: Field and Modeling Studies

GSA Hydrogeology Division. Todd W. Rayne, Hamilton College, Clinton, New York; Kenneth R. Bradbury, Wisconsin Geological and Natural History Survey, Madison. ORAL

Hydrogeology [13]

T82 ■ Field-Scale Hydrodynamic and Geochemical Interactions at the Interface of Groundwater and Surface Water

GSA Hydrogeology Division. Thomas C. Winter, U.S. Geological Survey, Lakewood, Colorado; William W. Woessner, University of Montana, Missoula. ORAL

Hydrogeology [13], Geochemistry, Aqueous [6], Geomicrobiology [9]

T83 ■ From Atrazine to Antibiotics: The Occurrence and Fate of Agricultural Chemicals in the Hydrologic System

GSA Hydrogeology Division. Dana W. Kolpin, U.S. Geological Survey, Iowa City, Iowa; Peter B. McMahon, U.S. Geological Survey, Lakewood, Colorado. ORAL

Hydrogeology [13]

T84 ■ Gulf of Mexico Hypoxia: A Multidisciplinary, Multiscale Problem

GSA Hydrogeology Division. Anne E. Carey, University of Alabama, Tuscaloosa; Michael R. Burkart, Iowa State University, Ames. ORAL

Hydrogeology [13], Marine/Coastal Science [14], Environmental Geoscience [5]

T85 ■ From Atrazine to Hypoxia to Antibiotics: Occurrence and Fate of Agrichemicals in the Hydrologic System

GSA Hydrogeology Division. Michael R. Burkart, Iowa State University, Ames; Anne E. Carey, University of Alabama, Tuscaloosa. POSTER

Hydrogeology [13], Marine/Coastal Science [14], Environmental Geoscience [5]

T86 ■ Hydrochemistry of Springs

GSA Hydrogeology Division. Brian G. Katz, Tallahassee, Florida; Carol Wicks, University of Missouri, Columbia. ORAL

Hydrogeology [13], Geochemistry, Aqueous [6]

T87 ■ Measurement Techniques and Modeling of Spatial and Temporal Variability in Groundwater Recharge in Response to Past, Present, and Future Climates

GSA Hydrogeology Division. Bridget Scanlon, University of Texas at Austin; Alan Flint; Lorrie Flint, Sacramento State University, Sacramento, California. ORAL

Hydrogeology [13], Environmental Geoscience [5]

T88 ■ Role of Groundwater Models in Water Rights Disputes: An Evolution in the Understanding of Large-Scale Hydrologic Systems in the Western United States

GSA Hydrogeology Division. Charles B. Andrews, S.S. Papadopoulos & Associates, Bethesda, Maryland. ORAL

Hydrogeology [13], Engineering Geology [4]

T89 ■ Sustainability of Water Resources in the High Plains

GSA Hydrogeology Division. Marios Sophocleous; Rex Buchanan, Kansas Geological Survey, Lawrence. ORAL
Hydrogeology [13], Environmental Geoscience [5], Engineering Geology [4]

T90 ■ Hydrologic Resources of Synorogenic Strata

GSA Hydrogeology Division. William E. Sanford, Colorado State University, Fort Collins; Robert G. Reynolds, Kirk Johnson, Denver Museum of Natural History, Denver, Colorado. ORAL
Hydrogeology [13], Stratigraphy [29], Tectonics [31]

T91 ■ Low-Recharge Groundwater Systems

Todd F. Battey, Earth Tech, Palmdale, California; John A. Izbicki, U.S. Geological Survey, San Diego, California. ORAL
Hydrogeology [13], Environmental Geoscience [5], Geochemistry, Aqueous [6]

T92 ■ Sediments in Karst Systems: Processes, Mechanisms, Interpretation

GSA Hydrogeology Division; Karst Waters Institute, GSA Quaternary Geology and Geomorphology Division, GSA Sedimentary Geology Division. Ira D. Sasowsky, University of Akron, Akron, Ohio; John E. Mylroie, Mississippi State University, Mississippi State; Victor J. Polyak, Texas Tech University, Lubbock. ORAL and POSTER
Hydrogeology [13], Sediments, Clastic [28], Quaternary Geology/Geomorphology [25]

T93 ■ Impacts of Urbanization on Groundwater Quantity and Quality

GSA Hydrogeology Division. William S. Logan, George Washington University, Washington, D.C.; John M. Sharp, University of Texas at Austin. ORAL
Hydrogeology [13], Geochemistry, Aqueous [6], Engineering Geology [4]

T94 ■ Source Protection Planning for Springs and Tunnels: Problems and Solutions

Sue A. Finstick, Bulloch Brothers Engineering, Cedar City, Utah; James H. Martin, Utah Department of Environmental Quality, Salt Lake City. ORAL
Hydrogeology [13]

T95 ■ Wetland Hydrology and Geochemistry: The State of the Science

GSA Hydrogeology Division. Donald I. Siegel, Syracuse University, Syracuse, New York. ORAL
Hydrogeology [13], Geochemistry, Aqueous [6], Environmental Geoscience [5]

T96 ■ Subsurface Transport, Fate, and Remediation of Nonaqueous Phase Liquid Contaminants in Multicomponent Biogeochemical Systems

GSA Hydrogeology Division. John E. McCray, Colorado School of Mines, Golden; Mark L. Brusseau, University of Arizona, Tucson. ORAL
Hydrogeology [13], Geochemistry, Aqueous [6], Environmental Geoscience [5]

T97 ■ Evolution and Remediation of Acid-Sulfate Groundwater Systems at Reclaimed Mine Sites

GSA Hydrogeology Division. Joseph J. Donovan, West Virginia University, Morgantown; David Atkins, Exponent Environmental Group, Boulder, Colorado. ORAL
Hydrogeology [13], Environmental Geoscience [5]

T98 ■ Sources, Transport, Fate, and Toxicology of Trace Elements in the Environment: A Tribute to Jerome Nriagu

David T. Long, Michigan State University, East Lansing; Gunter Faure, Ohio State University, Columbus. ORAL
Geochemistry, Aqueous [6], Environmental Geoscience [5], Economic Geology [3]

Premeeting Sessions

T99 ■ Janus I: Impact of Research on Mineral Exploration: A Century-Long Retrospective

Society of Economic Geologists. Richard I. Grauch, Denver, Colorado; Richard W. Hutchinson, Colorado School of Mines, Golden. ORAL (All invited papers)
Economic Geology [3]

T100 ■ The Sustainability Challenge II: Water and Human Sustainability

Institute for Environmental Education; GSA Committee on Critical Issues. Allison R. (Pete) Palmer, Boulder, Colorado; Kenneth E. Kolm, Colorado School of Mines, Golden. ORAL (All invited papers)
Environmental Geoscience [5]

T101 ■ Mission-Driven Geology: Meeting Global Challenges and Society's Needs

M. Lee Allison, Utah Geological Survey, Salt Lake City. ORAL (All invited papers)
Public Policy [24], Non-geoscience [33]

T102 ■ Perspectives on Our Ancestors: Old World and New World Human Populations

Geochemical Society, Organic Geochemistry Division. Michael H. Engel, University of Oklahoma, Norman; Stephen A. Macko, University of Virginia, Charlottesville. ORAL (All invited papers)
Geochemistry, Other [7], Archaeological Geology [1], Quaternary Geology/Geomorphology [25]

T103 ■ Biological Diversity in the Phanerozoic: In Memory of Jack Sepkoski

Paleontological Society. David Jablonski, University of Chicago, Chicago; Mary Droser, University of California, Riverside. ORAL
Paleontology/Paleobotany [18]



Oglicene and Miocene sedimentary rocks, Pawnee National Grassland, Colorado—Photo by John A. Karachewski

How To Submit Your Abstract

Abstracts Fee: \$15 (electronic and paper submissions)

■ Submit Abstract via the Web (www.geosociety.org)

Abstracts for the 1999 Annual Meeting in Denver can be sent to GSA via the Web (~72% of the abstracts were submitted electronically in 1998). *Note:* electronic abstracts may be sent to GSA only via the Web. They may not be sent by e-mail. The GSA Web abstract system will accept only abstracts containing pure ASCII content (no graphics, tables, symbols, Greek, superscripts, etc.). If you must use non-ASCII characters in your abstract, please use the paper form. Once your abstract is submitted on the Web, you will receive an immediate e-mail confirmation of receipt from GSA, with an abstract number assigned.

It's Easy To Submit Electronically

1. Compose your abstract in your favorite word processor. Do NOT compose your abstract on-line, because your server may disconnect during the time lag.
2. "Save" the abstract as "text." This will convert your data into pure ASCII.
3. Copy and paste this into the appropriate fields of the GSA Web form.
4. Complete the personal information on the form, including credit card information for abstracts fee payment (required for both paper and electronic forms).
5. Hit the "SEND" button. You're done! We've included instructions, pull-down lists, and helpful hints on the Web form to save you time and confusion. There's even an error checker to make certain you include all the necessary information.

Example Submission

Topical Submissions must include:

- Topical Session number—T92
- Key words of the topical session title—Sediments in Karst Systems
- One discipline category—Hydrogeology (#13 on abstract form)
- Mode for the session—Oral

Please check the correct mode—Oral or Poster

Presentation Modes

Oral Mode—This is a verbal presentation before a seated audience. The normal length of an oral presentation is 12 minutes, plus three minutes for discussion. Projection equipment consists of two 35 mm projectors, one overhead projector, and two screens. Requests for video projection and computer display will be addressed on a case-by-case basis. When you submit your paper, please indicate if you have special presentation needs.

Poster Mode—Each poster session presenter is provided with two horizontal, freestanding display boards approximately 8' wide and 4' high. Precise measurements will appear in the *Speaker Guide*, which will be available in August. The speaker must be at the poster booth for at least two of the four presentation hours.

Papers for discipline sessions may be submitted in either oral or poster mode. Papers for topical sessions are to be submitted only in the mode noted in the session description. If a topical abstract is submitted in the incorrect mode, the abstract will be transferred automatically to a discipline session.

Fall colors and
Lake Creek near
Continental
Divide, Mt. Hope
trail, Sawatch
Range, San Isabel
National Forest,
Colorado—Photo
by John A.
Karachewski



■ Submit Abstract on Paper

Paper forms have already been distributed for 1999, and can be obtained from Nancy Carlson, GSA Abstracts Coordinator, (303) 447-2020, ext. 161, ncarlson@geosociety.org.

Paper abstract forms are available from:

- Abstracts Coordinator at GSA headquarters
- Conveners of keynote symposia
- Advocates of topical sessions
- Geoscience departments of most colleges and universities
- Main federal and state survey offices

YOU MAY SUBMIT ONLY ONE VOLUNTEERED ABSTRACT

Please submit only one *volunteered* abstract as speaker or poster presenter in topical and/or discipline sessions. This helps avoid speaker-scheduling conflicts and gives everyone an equal opportunity to be heard. Multiple submissions as speaker-presenter may result in rejection of all abstracts. This limitation does not apply to, nor does it include, invited contributions to keynote symposia or topical sessions.

ABSTRACTS FEE: \$15 (electronic and paper submissions)

JOINT TECHNICAL PROGRAM COMMITTEE (JTPC) FINALIZES PROGRAM: AUGUST 2

The JTPC selects abstracts and determines the final session schedule. Speakers will be notified in late August (probably much sooner for abstracts submitted electronically). The JTPC includes representatives from those GSA Associated Societies and Divisions participating in the technical program. The JTPC technical program chairs were nominated by the Denver Annual Meeting Committee and approved by the GSA Council.

**Abstracts Deadline:
July 12**



Students, spouses, and interested guests are cordially invited to attend. Trips are technical in nature, and some can be physically rigorous. Participants should be prepared for wet, cold weather. Trips are one to seven days long and are led by active field researchers. *Minimum registration for field trips is 12 unless otherwise stated.*

If you register for *only* a field trip, you must pay a \$35 nonregistrant fee in addition to the field trip fee. This fee may be applied toward meeting registration if you decide to attend the meeting. Trip fees include transportation during the trip and a guidebook. Other services such as meals and lodging are noted by the following symbols: B—breakfast, L—lunch, R—refreshments, D—dinner, ON—overnight lodging.

All trips begin and end in Denver at the Colorado Convention Center, Lobby B, *unless otherwise indicated*. Some returning post-meeting trips can stop at Denver International Airport to discharge participants who have evening flights or would prefer to spend the night in a motel closer to the airport. Participants are cautioned against scheduling any tight travel connections with field trip return times, because those times are estimates, and delays in the field can occur. For a list of hotels near the airport and phone numbers, contact Edna Collis, GSA Field Trip Coordinator, (303) 447-2020, ext. 134, ecollis@geosociety.org.

Cancellation deadline is September 24. No refunds will be given after this date. If GSA must cancel a field trip because of logistics or if minimum registration requirements are not met, a full refund will be issued to you after the meeting. Be aware of flight-change penalties imposed by the airlines. Plan alternatives in advance should the trip you are registered for be canceled.

Attention students: The *GSA Sedimentary Geology Division* is cosponsoring three field trips and will subsidize all students who are valid division members. (See individual trip descriptions for those sponsored.) Students *must pay the full field trip fee* when registering, but will be reimbursed \$100 after the GSA meeting by the Sedimentary Geology Division. To be reimbursed, students *must apply in writing* to David McCormick, Schlumberger-Doll Research, Old Quarry Road, Ridgefield, CT 06877, (203) 431-5524, mccormic@ridgefield.sdr.slb.com.

The Colorado Scientific Society is also cosponsoring several field trips and is offering financial support to students from local colleges. (See individual trip descriptions for those sponsored.) Contact Mark Hudson, (303) 236-7446, mhudson@usgs.gov; or Chuck Pillmore, (303) 236-1240, cpillmor@usgs.gov for details.

For further information, contact the trip leader or 1999 Field Trip Co-Chairs Alan Lester, (303) 492-6172, and Bruce Trudgill, (303) 492-2126, Department of Geological Sciences, Campus Box 399, University of Colorado, Boulder, CO 80309, fax 303-492-2606, alan.lester@colorado.edu, bruce@lolita.colorado.edu.

Premeeting Trips

1. Cretaceous Hydrocarbon Plays—Southern Colorado

Thursday–Saturday, October 21–23. Cosponsored by *GSA Sedimentary Geology Division*. Paul R. Krutak, Geoservices International, 2118 Main St., P.O. Box 369, Rye, CO 81069, (719) 489-2282, fax 719-489-2282; rhi@fone.net. Maximum: 30; minimum: 12. Cost: \$290 (2B, 3L, 3D, R, 2ON, vans).

Hydrocarbons occur in Codell–Juana Lopez (Turonian) sandstones in the Denver Basin. These rocks were the object of an intensive oil and gas play (1981–1984) in the Denver Basin, and are superbly exposed at the surface in southern Colorado. We will examine surface equivalents of these near: (1) Colorado Springs (Louisiana State University Field Station and Gold Camp Road),

(2) Canon City and Garden Park (Florence field, Cope Marsh dinosaur quarries), and (3) Beulah, Rye, and Badito (Huerfano Basin Area).

2. Origin and History of the Heart Mountain Detachment and Associated Structures, Northeast Absaroka Range, Wyoming

Thursday–Sunday, October 21–24. David Malone, Dept. of Geography-Geology, Illinois State University, Normal, IL 61790-4400, (309) 438-2692, fax 309-438-5310, dhmalon@ilstu.edu; Tom Hauge, Edward Beutner. Maximum: 27; minimum: 12. Cost: \$375 (3B, 3L, 3D, R, 3ON, vans).

This field trip will provide a forum in which the important aspects of the Heart Mountain Detachment can be viewed, interpreted, compared, and contrasted. Foremost questions to be addressed include: What factors triggered the initiation of the upper plate of the detachment? What factors facilitated movement across the detachment surface? What was the mode of detached rock emplacement? How can rates of emplacement be constrained? Accommodations provided by the Double Diamond X guest ranch near Cody, Wyoming.

3. Hydrogeology and Wetlands of the Mountains and Foothills near Denver, Colorado

Saturday, October 23. Kenneth E. Kolm, Div. of Environmental Sciences, Colorado School of Mines, Golden, CO 80401, (303) 273-3932, fax 303-273-3413, kkolm@mines.edu; John C. Emerick. Maximum: 40; minimum: 12. Cost: \$80 (1L, R, vans).

This trip integrates the geomorphic, botanic, and hydrogeologic aspects of diverse groundwater and surface-water systems of the Geneva Creek sub-basin near Guanella Pass, Colorado. Fracture-flow crystalline bedrock systems, and alluvial, colluvial, and glacial systems are integrated for slope and riverine wetland structure and function.

4. Coal Mining in the 21st Century

Saturday–Sunday, October 23–24. Cosponsored by *GSA Coal Geology Division*. Michael Brownfield, U.S. Geological Survey, MS 972, P.O. Box 25046, Federal Center, Denver, CO 80225, (303) 236-7767, fax 303-236-5888, mbrownfield@usgs.gov; Ronald Afflotter, Edward Johnson, Charles Barker, and Trapper Mining, Inc. personnel. Maximum: 20; minimum: 12. Cost: \$180 (2L, R, 1ON, vans).

We will travel to the Yampa coal field, northwest Colorado, and discuss regional stratigraphy and the current coal assessment. We will visit the Trapper Mine and will address the environmental concerns related to mining and utilization of coal, including reclamation, sulfur emissions, trace-elements, minerals, coal combustion products, characterization, and effective waste management.

The GSA
Field Trip Guidebook Series
debuts in 1999.

The first volume will contain several of the 1999 field trip guides. Look for this new series at the GSA Bookstore and in the registration area. After the meeting, copies will be available for purchase through GSA Publication Sales, 1-800-472-1988, ext. 152.

NEW GSA
PUBLICATION

5. K-T Boundary in the Raton Basin, New Mexico and Colorado: Evidence for Asteroid Impact

Saturday–Sunday, October 23–24. Cosponsored by *GSA Sedimentary Geology Division; Colorado Scientific Society*. Charles (Chuck) L. Pillmore, U.S. Geological Survey, MS 913, P.O. Box 25046, Federal Center, Denver, CO 80225, (303) 236-1240, fax 303-236-0214, cpillmor@usgs.gov; Doug Nichols, Farley Fleming. Maximum: 33; minimum: 18. Cost: \$180 (1B, 2L, 1D, R, 1ON, vans).

The Raton basin has more than 20 sites where the Cretaceous-Tertiary (K-T) boundary is preserved in continental coal-bearing rocks of the Raton Formation. The boundary is marked by a thin clay layer that contains physical, chemical, and paleontological evidence of the asteroid or comet impact at the end of the Mesozoic. On this trip we will study the stratigraphy and geology of the basin, examine several of these sites where the boundary clay is well exposed, and discuss the evidence and the origin of the clay bed.

6. Laramide to Holocene Structural Development of the Northern Colorado Front Range

Saturday–Sunday, October 23–24. Cosponsored by *Colorado Scientific Society*. Eric A. Erslev, Dept. of Earth Resources, Colorado State University, Fort Collins, CO 80523, (970) 491-5661, fax 970-491-6307, erslev@cnr.colostate.edu; Karl Kellogg, Bruce Bryant. Maximum: 33; minimum: 12. Cost: \$185 (1B, 2L, 1D, R, 1ON, vans).

We will traverse the highly asymmetrical Northern Front Range, examining the west flank's major Laramide thrusts and subsequent volcanics and normal faults as well as the east flank's higher-angle thrusts and fault-propagation folds. Laramide-to-Holocene tectonics will be debated on the outcrop and during our evening soak at Hot Sulphur Springs.

7. 200,000 Years of Climate Change Recorded in Eolian Sediments of the High Plains of Eastern Colorado and Western Nebraska

Saturday–Sunday, October 23–24. Cosponsored by *GSA Sedimentary Geology Division*. Dan Muhs, U.S. Geological Survey, MS 963, P.O. Box 25046, Federal Center, Denver, CO 80225; (303) 236-7919, fax 303-236-5349, dmuhs@usgs.gov; James Swinehart, David Loope. Maximum: 30, minimum: 12. Cost: \$185 (2L, R, 1ON, vans).

Participants will see key eolian records for paleoclimate in Colorado and Nebraska. Visits include the last interglacial Sangamon soil, overlain by the thickest last-glacial loess in North America, and the Nebraska Sand Hills (the largest dune field in



Garden of the Gods and Pikes Peak, Colorado—Photo courtesy of Denver Metro Convention and Visitors Bureau

North America), where there has been widespread dune activity in the Quaternary.

8. Active Evaporite Tectonics and Collapse in the Southeastern and Southwestern Flanks of the White River Uplift, Western Colorado

Sunday, October 24. Cosponsored by *Colorado Scientific Society*. Robert B. Scott, U.S. Geological Survey, MS 913, P.O. Box 25046, Federal Center, Denver, Colorado 80225, (303) 236-1230, fax 303-236-0214, rbscott@usgs.gov; David L. Lidke, Bruce Bryant, Mark R. Hudson, Mick J. Kunk, William J. Perry, James R. Budahn, Frank M. Byers, Jr. Maximum: 40; minimum: 27. Cost: \$80 (1L, R, vans).

Between Minturn and Rifle Falls, we will demonstrate collapse features caused by Neogene dissolution of about 2250 km³ of Pennsylvanian evaporite by observing plateau basalts that have collapsed more than 1 km, expressed by sags and faults involving the 30 × 10 km Hardscrabble Mountain, the Eagle river basin, and parts of the Grand Hogback.

9. Bouncing Boulders, Rising Rivers, and Sneaky Soils: A Primer to Geological Hazards and Engineering Geology Along Colorado's Front Range

Sunday, October 24. Cosponsored by *GSA Engineering Geology Division; Colorado Scientific Society*. David C. Noe, Colorado Geological Survey, 1313 Sherman St., Room 715, Denver, CO 80203; (303) 866-2432; fax 303-866-2461, dave.noe@state.co.us; James M. Soule, Jeffrey L. Hynes, Karen A. Berry. Maximum: 90; minimum: 43. Cost: \$65 (1L, R, bus).

The Front Range Urban Corridor, from Boulder to Highlands Ranch, contains an astonishing array of geological hazards that affect everyday life in Colorado. We will examine the role of engineering geology as applied to expansive soil and rock, mine subsidence, underground mine fires, rockfall, earthquakes, debris flows, floods, landslides, quarries and reclamation issues, and ground-water and atmospheric hazards.

10. Cave of the Winds and Springs of Manitou, Colorado: Geology and Hydrology

Sunday, October 24. Fred Luiszer, Dept. of Geological Sciences, University of Colorado, Boulder, CO 80309, (303) 492-5251, fax 303-492-2606, luiszer@spot.colorado.edu. Maximum: 40; minimum: 12. Cost: \$85 (1L, R, bus).

We will visit Cave of the Winds, where we will discuss cave sediments and related sediments outside of the cave. After a box lunch at the Iron Springs Chateau, we will visit some of the springs of Manitou. We will discuss the relationship of spring geochemistry and spring sediments to Cave of the Wind sediments.

11. Geological Reconnaissance of Dinosaur Ridge and Vicinity

Sunday, October 24. Norb Cygan, (303) 660-9792, necygan@aol.com; Betty Rall, "T" Caneer, Bob Reynolds, Friends of Dinosaur Ridge, Morrison, Colorado. Maximum: 40; minimum: 12. Cost: \$70 (1L, R, vans).

This trip features geologic reconnaissance along Alameda Parkway (including Dinosaur Ridge) and a stop in Red Rocks Park for a regional geologic discussion. Also included is a stop in Turkey Creek Canyon to examine a live oil seep, a fault, and a textbook example of a uranium occurrence.

12. Kimberlites of the Colorado-Wyoming State Line District

Sunday, October 24. Cosponsored by *Colorado Scientific Society*. Pete Modreski, U.S. Geological Survey, MS 915, P.O. Box 25046, Federal Center, Denver, CO 80225, (303) 236-5639, fax 303-236-5448, pmodresk@usgs.gov; Tom Michalski. Maximum: 26; minimum: 12. Cost: \$90 (1L, R, vans).

We will visit two of the 30+ kimberlite pipes and dikes in the State Line district, including a one-hour hike to the Green Mountain pipe near Boulder, and one of the pipes northwest of Fort Collins. Two 28-carat diamonds have been recovered during recent mining in the district.

Half Day—During the Meeting

13. Walking Tour of Paleontologist G. G. Simpson's Boyhood Neighborhood

Sunday, October 24, 1:00 to 5:00 p.m. Cosponsored by *GSA History of Geology Division*. Leo Laporte, Earth Sciences Dept., University of California, 1156 High St., Santa Cruz, CA 95064, (650) 364-3386, laporte@cats.ucsc.edu. Maximum: 12; no minimum. Cost: \$10.

In the Denver neighborhood where George G. Simpson (1902–1984), paleontologist and evolutionist, spent his youth, we'll view two of the houses where he lived; childhood home of his playmate (and future wife); and church, elementary school, and street corner where he sold lemonade to buy the Encyclopaedia Britannica.

14a/b. Geology Tour of Denver Buildings and Monuments

Monday, October 25, 1:00 to 4:00 p.m. OR Wednesday, October 27, 1:00 to 4:00 p.m. Cosponsored by *GSA Archaeological Geology Division*. Jack Murphy, Denver Museum of Natural History, Dept. of Earth & Space Sciences, 2001 Colorado Blvd., Denver, CO 80205, (303) 370-6445, fax 303-331-6492. Maximum: 40 (each trip); no minimum. Cost: \$10.

Join Jack Murphy, author of "Geology Tour of Denver's Buildings and Monuments," in a walking tour to learn about the types and sources of building stones in downtown historic buildings and how they relate to Colorado's geologic history. View the granites, sandstones, and marbles used in the Civic Center, U.S. Mint, Public Library, and State Capitol.

15 a/b. Tour of the U.S. Geological Survey Mapping and Geologic Facilities, Denver Federal Center

Tuesday, October 26, 12:30 to 5:00 p.m. OR Wednesday, October 27, 12:30 to 5:00 p.m. Pete Modreski, U.S. Geological Survey, Box 25046, MS 915, Federal Center, Denver, CO 80225, (303) 236-5639, fax 303-236-5348, pmodreski@usgs.gov; Joseph Kerski. Maximum: 24; no minimum. Cost: \$15.

We will tour the U.S. Geological Survey labs at the Denver Federal Center, including the National Ice Core Laboratory (30,000 ft of polar ice core), Core Research Center (1.4 million ft of drill core), Rocky Mountain Mapping Center (topo maps, GIS, digital data), and the new National Water Quality Laboratory.

Postmeeting Trips

16. Geological Reconnaissance of Dinosaur Ridge and Vicinity

Friday, October 29. Norb Cygan, (303) 660-9792, necygan@aol.com; Betty Rall, "T" Caneer, Bob Raynolds, Friends of Dinosaur Ridge, Morrison, Colorado. Maximum: 40; minimum: 12. Cost: \$70 (1L, R, vans).

See Trip 11 for description.

17. Laramide Minor Faulting and Tectonics of the Northeastern Front Range of Colorado

Friday, October 29. Cosponsored by *Colorado Scientific Society*. Eric A. Erslev, Dept. of Earth Resources, Colorado State University, Fort Collins, CO 80523, (970) 491-5661, fax 970-491-6307, erslev@cnr.colostate.edu; Steve Holdaway. Maximum: 22; minimum: 12. Cost: \$85 (1L, R, vans).

The northeastern Front Range provides an excellent test of Laramide tectonic hypotheses. This trip will feature moderate

hikes to excellent exposures of basement-involved structures. We will integrate new fault, paleomagnetic, and balancing data into a general model for back limb deformation in basement-cored foreland arches.

18. Soil-Geomorphic Relationships Near Rocky Flats, Boulder and Golden, Colorado, With a Stop at the Pre-Fountain Formation of Wahlstrom

Friday, October 29. Cosponsored by *Colorado Scientific Society*. Peter Birkeland, Dept. of Geological Sciences, University of Colorado, Boulder, CO 80309, (303) 492-5661, fax 303-492-2606, birkelap@stripe.colorado.edu; Ralph Shroba, Penny Patterson. Maximum: 24; minimum: 14. Cost: \$90 (1L, R, vans).

We will first visit the pre-Fountain paleosol described by Wahlstrom (1948): What is it? We will see the 2-m.y.-old Coal Creek soil chronosequence, including Rocky Flats, and an old red soil on valley slopes. Finally, a sequence of buried soils estimates the age of the Rocky Flats alluvium, in part using paleomagnetic data.

19. South Park Conjunctive Use Project: A Combined Look at Geology and Hydrology in the South Park Basin, Colorado

Friday, October 29. Michael F. McHugh, City of Aurora Water Resources Division, 1450 S. Havana, Aurora, CO 80012, (303) 739-7006, fax 303-739-7604, mmchugh@ci.aurora.co.us; Jim Jehn, Harvey Eastman. Maximum: 40; minimum: 12. Cost: \$80 (1L, R, vans).

The South Park Basin is a faulted syncline, truncated on the east by the Elkhorn thrust fault that contains 16 million AF of water. Stops on the field trip will include Kenosha Pass, outcrops of the Cretaceous and Tertiary sediments, and Precambrian uplands. This trip will be an opportunity to see a sustainable, environmentally sensitive way to provide water to the City of Aurora.

20. Stratigraphy, Sedimentology, and Paleontology of the Cambrian-Ordovician of Colorado

Friday–Saturday, October 29–30. Paul M. Myrow, Dept. of Geology, Colorado College, Colorado Springs, CO 80903, (719) 389-6790, fax 719-389-6910, pmyrow@coloradocollege.edu; John Taylor, James Miller, Ray Ethington, Robert Ripperdan, Christina Brachle. Maximum: 30; minimum: 12. Cost: \$240 (2L, R, 2ON, vans).

We will compare the sedimentology, conodont and trilobite biostratigraphy, carbon isotope stratigraphy, and sequence stratigraphy of Cambrian-Ordovician rocks of Colorado from both sides of the Transcontinental Arch. We will examine the relationship of hiatal surfaces to gaps in the biostratigraphic and carbon-isotopic records for these carbonate and siliciclastic inner detrital belt rocks.

21. Geology and Paleontology of the Gold Belt Back-Country Byway: Florissant Fossil Beds and Garden Park Fossil Area

Friday–Saturday, October 29–30. Herb Meyer, National Park Service, Florissant Fossil Beds National Monument, P.O. Box 185, Florissant, CO 80816, (719) 748-3253, fax 719-748-3164, herb_meyer@nps.gov; T. W. (Woody) Henry, Dan Grenard, Emmett Evanoff. Maximum: 30; minimum: 12. Cost: \$175 (2L, R, 1ON).

This trip will visit Florissant Fossil Beds (famous for Eocene plants and insects), the Cripple Creek Mining district, the Garden Park dinosaur area (known for many original dinosaur discoveries in the past century), and the Indian Springs Ordovician marine trace-fossil site. Overnight lodging will be in the historic mining town of Cripple Creek.



GSA-Sponsored Short Courses

GSA short courses will be held immediately before the Annual Meeting and are open to members and nonmembers. If you register for *only* a short course, you must pay a \$35 nonregistrant fee in addition to the course fee. This fee may be applied toward meeting registration if you decide to attend the meeting. Preregistration is recommended; on-site registration is \$30 additional.



**Continuing
Education Unit
(CEU) Service**

All courses sponsored by GSA offer CEUs. A CEU is defined as 10 contact hours of participation in an organized continuing education experience under responsible sponsorship, capable direction, and qualified instruction. A contact hour is defined as a typical 60-minute classroom instructional session or its equivalent. Ten instructional hours are required for one CEU. For CEU record-keeping purposes, please be sure to include your social security number on the registration form.

Cancellation Deadline: September 24.

For more information, contact Edna Collis, GSA Continuing Education Coordinator, (303) 447-2020, ext. 134, or ecollis@geosociety.org.

1. Practical Methods in Applied Contaminant Geochemistry: From Characterization to Remediation

Saturday, October 23, 8:00 a.m. to 5:00 p.m. Colorado Convention Center. Cosponsored by *GSA Hydrogeology Division*.

STUDENTS: The *GSA Hydrogeology Division* will subsidize the first student registrant who is a valid division member. The student *must pay the full course fee* when registering, but will be reimbursed \$50 after the GSA meeting by the Hydrogeology Division.

The geochemical data obtained as part of regulatory-driven hydrogeologic investigations are commonly too incomplete, of scant number, and of insufficient quality to be effectively used in the rigorous approaches that are being taught. This course will teach the "practical" essentials of contaminant geochemistry and how to effectively apply them in consulting (and arguably academic!) practice.

Faculty: Donald I. Siegel, Dept. of Earth Sciences, Syracuse University; Ph.D., University of Minnesota.

Limit: 40. Fee: \$175, students \$155; includes course manual and lunch. CEUs: 0.8.

2. Applied Inverse Ground Water Modeling: Why Use Anything Less?

Saturday–Sunday, October 23–24, 8:00 a.m. to 5:00 p.m. both days. Colorado Convention Center. Cosponsored by *GSA Hydrogeology Division*.

STUDENTS: The *GSA Hydrogeology Division* will subsidize the first student registrant who is a valid division member. The student *must pay the full course fee* when registering, but will be reimbursed \$50 after the GSA meeting by the Hydrogeology Division.

The theory and philosophy of applied inverse modeling will be covered in this course through classroom and computer exercises. The methods will be presented, and specific examples will illustrate how inverse modeling can be used to troubleshoot model design, investigate alternative conceptual models, and quantify the uncertainty of model predictions.

Faculty: Evan R. Anderman, ERA Ground-Water Modeling, LLC, Denver; Ph.D., Colorado School of Mines; James O. Rumbaugh, Environmental Simulations, Denver.

Limit: 25. Fee: \$385, students \$365; includes course manual and lunches. CEUs: 1.6.

3. Digital Mapping Methods: Accurate Digital Data Capture and Analysis for the Field Geoscientist

Saturday–Sunday, October 23–24, 8:00 a.m. to 5:00 p.m. both days. Colorado Convention Center.

This course will provide an overview and specifics of the technology (GPS, lasers, etc.) and methodology for digital geologic mapping. Numerous case histories will illustrate mapping and analysis, from the most sophisticated to the most basic, least expensive configurations. Participants will generate and analyze a geologic map.

Faculty: Kent Nielsen, Dept. of Geosciences, University of Texas at Dallas; Ph.D., University of British Columbia; Carlos Aiken, Dept. of Geosciences, University of Texas at Dallas; Ph.D., University of Arizona; Xueming Xu, Dept. of Geosciences, University of Texas at Dallas; M.S., Chinese Academy of Science.

Limit: 40. Fee: \$385, students \$365, includes course manual, lunches, and field trip transportation. CEUs: 1.6.

4. Introduction to Remote Sensing for Geologic Applications

Saturday–Sunday, October 23–24, 8:00 a.m. to 5:00 p.m. both days. Colorado Convention Center. Cosponsored by *GSA Planetary Geology Division*.

STUDENTS: The *GSA Planetary Geology Division* will subsidize the first two student registrants who are valid division members. The students *must pay the full course fee* when registering, but will be reimbursed \$100 after the GSA meeting by the Planetary Geology Division.

This hands-on course will show you how basic remote-sensing techniques can be used for geologic applications. The course will cover the basic principles of remote sensing, how to choose and acquire data for a project, image processing techniques and data interpretation. Practical examples with both hard and soft rock terrain will be used in lecture and for computer exercises.

Faculty: Andrea Gallagher, Research Systems, Boulder, Colorado; B.S., Colorado School of Mines; Rebecca Dodge, University of Texas at El Paso; Ph.D., Colorado School of Mines; K. Eric Livo, U.S. Geological Survey, Denver; M.S., Colorado School of Mines.

Limit: 30. Fee: \$325, students \$305; includes course manual and lunches. CEUs: 1.6.

5. Modern Salt Tectonics

Saturday–Sunday, October 23–24, 8:00 a.m. to 5:00 p.m. both days. Colorado Convention Center. Cosponsored by *GSA Structural Geology and Tectonics Division*.

STUDENTS: The *GSA Structural Geology and Tectonics Division* offers five \$100 scholarships to Structural Geology and Tectonics Division-affiliated student members for Structural Geology and Tectonics Division-sponsored short courses. Apply in writing, giving name, institution, class, specialty, poster or talk title, short-course title, and a one-paragraph rationale, to Stephen Marshak by e-mail (smarshak@uiuc.edu) or fax 217-333-3542 from September 6 through September 10, 1999. See the Structural Geology and Tectonics newsletter for more information.

The field of salt tectonics has evolved radically over the past decade. This course will introduce modern concepts and models of diapirism and salt-related deformation using seismic and field examples from around the world, analog models, and structural restorations. Practical exercises involving simple seismic interpretation will supplement the lectures.

Faculty: Mark G. Rowan, Rowan Structural Consulting, Boulder, Colorado; Ph.D., University of Colorado, Boulder.

Limit: 50. Fee: \$265, students \$245; includes course manual and lunches. CEUs: 1.6.

6. Three-Dimensional Seismic Interpretation: A Primer for Geologists

Saturday–Sunday, October 23–24, 8:00 a.m. to 5:00 p.m. both days. Colorado Convention Center. Cosponsored by *GSA Sedimentary Geology Division*.

STUDENTS: The *GSA Sedimentary Geology Division* will subsidize all students who are valid division members. Students *must pay the full course fee* when registering, but will be reimbursed \$100 after the GSA meeting by the Sedimentary Geology Division. To be reimbursed, student *must apply in writing* to David McCormick, Schlumberger–Doll Research, Old Quarry Road, Ridgefield, CT 06877, (203) 431-5524, mccormic@ridgefield.sdr.slb.com

This introductory-level class will qualitatively introduce the theory and application of 3-D seismic technology to geologists. Upon completion of the course, participants will be familiar with the terminology, techniques, benefits, and pitfalls of 3-D seismic technology and will be able to make more competent judgments concerning its utilization.

Faculty: Bruce S. Hart, New Mexico Bureau of Mines and Mineral Resources; Ph.D., University of Western Ontario.

Limit: 40. Fee: \$280, students \$260; includes course manual and lunches. CEUs: 1.6.

7. Applications of Environmental Isotopes to Watershed Hydrology and Biogeochemistry

Sunday, October 24, 8:00 a.m. to 5:00 p.m. Colorado Convention Center. Cosponsored by *GSA Hydrogeology Division*.

STUDENTS: The *GSA Hydrogeology Division* will subsidize the first student registrant who is a valid division member. The student *must pay the full course fee* when registering, but will be reimbursed \$50 after the GSA meeting by the Hydrogeology Division.

This course will focus on practical applications of water, solute, and biomass isotopes for gaining a better understanding of the hydrology and biogeochemistry of watersheds and small basins. The wide range of discussion topics will include tracing water sources and pollutants, flowpath determination, biogeochemical reaction mechanisms, and food-web reconstruction.

Faculty: Carol Kendall, Water Resources Division, U.S. Geological Survey, Menlo Park, California; Ph.D., University of Maryland; Thomas D. Bullen, Water Resources Division, U.S. Geological Survey, Menlo Park, California; Ph.D., University of California, Santa Cruz.

Limit: 40. Fee: \$275, students \$255; includes course manual and lunch. CEUs: 0.8.

8. Teaching Earth System History: A Computer-Assisted Approach

Sunday, October 24, 8:00 a.m. to 5:00 p.m. Colorado Convention Center.

This course reviews the plate tectonic development of the oceans and continents, discusses the coevolution of lithosphere, atmosphere, and oceans, and presents PC-based software and animations that dynamically portray the evolution of the Earth System.

Faculty: Christopher R. Scotese, Department of Geology, University of Texas at Arlington; Ph.D., University of Chicago.

Limit: 30. Fee: \$175, students \$155; includes course manual, CD-ROM, software, and lunch. CEUs: 0.8.

Other Courses, Workshops, and Forums

Application of Radiogenic Isotopes to Ore Deposit Research and Exploration

Saturday, October 23, 8:00 a.m. to 5:00 p.m. Sponsored by *Society of Economic Geologists*.

There have been many advances in the past decade in our understanding of isotope systems as applied to hydrothermal systems and in the analytical techniques required for the use of new isotope systems particularly useful for ore-deposit research. This course explains the key radiogenic isotopic systems—Rb–Sr, Sm–Nd, U–Pb, $^{40}\text{Ar}/^{39}\text{Ar}$ and Re/Os used in ore deposit research. These systems, when used in an integrated way, can yield important information on the age and duration of mineralization and the source of some of the components of the ore system. The course is designed for anyone with an understanding of magmatic and hydrothermal systems and basic chemistry. The short course volume is included in the registration fee.

Conveners: Joaquin Ruiz, Dept. of Geosciences, University of Arizona, Tucson, AZ 85721, (520) 621-4827, fax 520-621-2672, jruiz@geo.arizona.edu; David Lambert, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230, (703) 306-1554, dlambert@nsf.gov.

Limit: 100. Cost: \$190 SEG members; \$290 nonmember, \$95 certified students. Preregistration required. Send check, payable to Society of Economic Geologists, 5808 South Rapp St., Suite 209, Littleton, CO 80120, (303) 797-0332, fax 303-797-0417. Major credit cards also accepted.

Uranium: Minerals, Chemistry, and the Environment

Friday–Saturday, October 22–23. Holiday Inn Denver West Village, Golden, Colorado. Sponsored by *Mineralogical Society of America*.

This course covers uranium crystal chemistry, systematic uranium mineralogy, aqueous chemistry of uranium, uranium-ore genesis, and isotopic systems, as well as microbial influences on uranium geochemistry, remediation of uranium-contaminated sites, applications to radioactive waste disposal, and the natural fission reactors in Gabon, Africa. The accompanying *Reviews in Mineralogy* volume addresses analytical methods useful for mineralogical and geochemical research on uranium.

Limit: 100. Fee: \$265 MSA members, \$355 nonmembers, \$165 student MSA members, \$195 student nonmembers for registrations received before August 31. Includes course banquet. For information and registration: MSA Business Office, 1015 Eighteenth St., N.W., Suite 601, Washington, DC 20036-5274; (202) 775-4344, fax 202-775-0018, business@minsocam.org, or visit the MSA home page, <http://www.minsocam.org>

The Evolution–Creation Controversy II: Perspectives on Science, Religion, and Geological Education

Sunday, October 24, 8:00 a.m. to 5:00 p.m. Sponsored by *Paleontological Society*.

Earth science teachers are often confronted with the apparent conflict between “scientific” and “religious” approaches to questions of origins, especially when teaching about evolution. This course will discuss: ways to teach evolution convincingly; history and views of creationism and responses to the creationist challenge in the classroom; relationship of science and religion; and interpretation of the Biblical creation stories.

Faculty: Jonathan Bryan, G. Brent Dalrymple, Richard Bambach, Kevin Padian, Ronald Numbers, David Schwimmer, Davis Young, Robert Galstado, Eugenie Scott, Peter Dodson, Conrad Hyers, Roger Cuffey, Walter Manger, Michael Parrish, Patricia Kelley, and Thor Hansen.

GSA-Sponsored Short Courses

No fee or registration. Course notes will be available for purchase onsite. For information: Patricia H. Kelley, Chair, Dept. of Earth Sciences, University of North Carolina at Wilmington, 601 South College Rd., Wilmington, NC 28403-3297, (910) 962-7406, fax 910-962-7077, kelley@UNCWIL.edu.

Digital Database Forum

Wednesday, October 27. Sponsored by *Geoscience Information Society*.

Each year, this forum provides a venue where scientists, information specialists, and publishers gather and discuss issues concerning electronic resources and view new applications in electronic data for the earth sciences. The Digital Database Forum is open to all conference registrants, so mark your calendars, contact your colleagues, and plan to attend!

No fee or registration. For information: Adonna Fleming, Digital Database Committee Chair, Michener Library, University of Northern Colorado, Greeley, CO 80639; (970) 351-1530, fax 970-351-2963, acflemi@bentley.unco.edu.

K-16 Educational Workshops

K-16 Teachers, Graduate Students, and Scientists

GSA invites you to join us in Denver for a truly informative and progressive K-16 education program. Plan to preregister and come early. These workshops hold something for everyone and will no doubt fill up quickly!

Dinosaurs and Geo Resources—A Field Trip for K-12 Educators

Friday, October 22, 8:00 a.m. to 5:00 p.m.

Educators will visit the USGS ice core, mapping and Geocenter facilities in Denver. The USGS visit is coupled with a field trip to Dinosaur Ridge to investigate some of Colorado's largest and most famous former inhabitants. Educators will also examine Colorado's landscapes and geologic history, and learn how to develop inquiry-based field trips.

Limit: 40. Cost: \$10 (does not include lunch). Registration required. For information: Pete Modreski, USGS, pmodresk@usgs.gov; Lisa Barlow, CU Boulder, barlowl@spot.colorado.edu; Ed Geary, GSA, egeary@geosociety.org.

The Best of the USGS Educational Resources

Saturday, October 23, 8:00 a.m. to 12:00 noon

Expand your horizons in teaching science and geography with this workshop on the use of USGS educational resources. A USGS geologist and geographer in the education program will demonstrate the integration of local geology into teaching, the use of topographic and thematic maps as tools to explore the landscape, and the application of technology tools such as global positioning systems, real-time earthquake data, and hydrographic data on USGS web sites, and geographic information systems. Included in the workshop will be a discussion on recent scientific discoveries by the USGS and how to use these discoveries to engage students in learning.

No Limit. No cost. Registration required. For information: Joseph Kerski; (303) 202-4315, jkerski@usgs.gov.

Innovative Course Design for Teaching Undergraduate Geoscience

Saturday, October 23, 8:00 a.m. to 5:00 p.m.

This National Association of Geoscience Teachers workshop will give participants experience with a systematic method for designing innovative courses in geoscience. After a brief introduction, each participant will spend the day with the facilitators and other

participants on a course of his or her choice and will leave the workshop with a concrete plan for revising the course to make it more effective in terms of what students accomplish in the course.

Limit: 40. Cost: \$20. Registration required. For information: Barbara Tewksbury, Hamilton College, Clinton, NY 13323, (315) 859-4713, fax 315-859-4807, btewksbu@hamilton.edu.

Plate Tectonics: A Hands-on Exploration of Our Planet

Saturday, October 23, 8:00 a.m. to 5:00 p.m.

We will explore the basics of the plate tectonics theory through a variety of hands-on activities suitable for grades 4-12 and introductory college courses. Participants will build models and use the 3-D Plate Puzzle and a new CD-ROM to illustrate many concepts. We recommend taking this in conjunction with the workshop "Inquiry Learning in Plate Tectonics Using Real Earth Datasets."

Limit: 15. Cost: \$10. Registration required. For information: Leslie Sautter, College of Charleston, (843) 953-5586, sautterl@cofc.edu.

Preparing Graduate Students for Teaching

Saturday-Sunday, October 23-24, 8:00 a.m. to 5:00 p.m., with events on the evening of Saturday, October 23

This is a National Association of Geoscience Teachers workshop for earth science departments and programs interested in sharing ideas about strategies for preparing graduate students for responsibilities as teaching assistants as well as future roles as potential faculty members. The workshop will bring together faculty from different departments or programs having established successful teaching-preparation programs with those who want to implement or improve such programs. We strongly encourage applications from institutional teams that include faculty members, graduate students, and others, such as learning-center staff. Workshop topics will include the content and format of various teaching preparation programs, quality evaluation of teaching and of the program, and successes and challenges. Teams will devise institutionally specific action plans for establishing or improving TA and future faculty preparation programs. A National Science Foundation grant will cover lodging (shared room) and partial food expenses for up to two members of each team.

Limit: 60. Application and preregistration required. (Application deadline: August 17, 1999).

For application, information, and registration: Heather Macdonald, Dept. of Geology, College of William and Mary, P.O. Box 8795, Williamsburg, VA 23187, rhmacd@wm.edu, (757) 221-2443, fax 757-221-2093.

Evolution: Investigating the Evidence

Saturday, October 23, 8:00 a.m. to 5:00 p.m.

For teachers of grades 6-16, this workshop addresses the questions, What is the evidence for evolution? Why the controversies? How can teachers present major evolutionary concepts in their classes in meaningful ways? Join an energetic team of paleontologists and science educators in a full-day, hands-on workshop. We will concentrate on what science is and is not, the importance of teaching evolution, and best teaching strategies. The format will be a combination of informative sessions and discussions followed by activities presented by grade level. All participants receive free materials for the classroom and a complimentary copy of a 300-page resource book.

Limit: 70. Cost: \$20. Registration required. For information: Dale Springer, Bloomsburg University, (570) 389-4747, dspringe@planetx.bloomu.edu; Judy Scotchmop, University of California, Berkeley, (510) 642-4877, judys@ucmp1.berkeley.edu.

How To Get Started in Research

Sunday, October 24, 8:00 a.m. to 12:00 noon

Sponsored by *Council on Undergraduate Research, Geology Division*

This workshop will present strategies and approaches for developing and sustaining research programs at the undergraduate level. It is designed for new geoscience faculty, including graduate students preparing to enter academic positions, who are interested in developing an undergraduate research program, as well as faculty interested in rejuvenating their research program. Topics will include funding opportunities, selection of research projects appropriate for undergraduates, academic preparation of students, and institutional support for undergraduate research.

Limit: 20. Cost: \$20. Registration required. For information: Jill Singer, Buffalo State College, (716) 878-4724, singerjk@buffalostate.edu; Ed Hansen, Hope College, (616) 395-7538, hansen@hope.edu.

Earthquakes

Sunday, October 24, 8:00 a.m. to 5:00 p.m.

Sponsored by *Incorporated Research Institutions for Seismology (IRIS) Consortium* with funding from the *National Science Foundation*

This workshop is for college faculty who teach introductory earth science courses and who wish to learn more about earthquakes, seismology, and related plate tectonics for use in their teaching. Topics will include causes of earthquakes, earthquakes and plate tectonics, propagation of seismic waves, seismographs, earthquake locations, statistics and data, Earth's interior structure, and earthquake hazards. Lessons and activities presented will emphasize hands-on, inquiry-based learning. About \$120 worth of materials (notebook with lessons and hands-on activities, maps, curriculum materials, earthquake book, posters, software, and other teaching aids) will be provided to each participant.

Faculty: Michelle Hall-Wallace, University of Arizona; Lawrence W. Braile, Purdue University; Catherine Johnson, IRIS Consortium.

Limit: 25. No cost. Send a brief letter of application (including your phone and fax numbers and e-mail address) indicating your interest and describing your earth science teaching duties to: Earthquake Workshop, L.W. Braile, Dept. of Earth & Atmospheric Sciences, 1397 Civil Engineering Bldg., Purdue University, West Lafayette, IN 47907-1397. Letters of application must be received by September 1. You will be notified of the decision concerning your participation by September 8. If we do not have 25 participants by September 8, we may be able to accept late applications. For information: Lawrence W. Braile, Purdue University, (765) 494-5979, braile@purdue.edu.

Inquiry Learning in Plate Tectonics Using Real Earth Datasets

Sunday, October 24, 8:00 a.m. to 12:00 noon

After a brief introduction to the theory of plate tectonics, you will learn how to use the "One Day" GIS data to implement activities that allow students to discover evidence that supports the theory of plate tectonics. Emphasis will be on how an authentic science experience can be framed so that your students will experience some of the excitement and obstacles that scientists experience. We will discuss issues relating to scientific writing. We will also identify investigations that could be done with the datasets, so that you can better advise your stu-

dents. We recommend taking in conjunction with the workshop "Plate Tectonics: A Hands-on Exploration of Our Planet."

Limit: 15. Cost: \$20. Registration required. For information: William A. Prothero, University of California, Santa Barbara, Prothero@magic.ucsb.edu.

Exploring the Solar System for Special Needs Kids

Sunday, October 24, 8:00 a.m. to 5:00 p.m.

Sponsored by *NASA*

We will explore various methods of presenting earth and planetary science curricula in the classroom using a newly developed multisensory kit with Braille maps, music, and hands-on activities. Activities support the national science standards. All registered and attending participants will receive a multisensory kit for use in their classroom or school that includes books, posters, projects, videos, and more. Dress casual—we will be making messes!

Limit: 30. Cost: \$20. Preregistration required. For information: Cassandra Coombs, College of Charleston, (843) 953-8279, coombsc@cofc.edu.

Introduction to GIS and ArcView for Geoscience Education

Sunday, October 24, 8:00 a.m. to 12:00 noon

Sponsored by *Environmental Systems Research, Inc. (ESRI)*

This workshop provides K-12 educators with a combination minds-on and hands-on GIS experience (with approximately 2.5 hours of hands-on exposure to ArcView 3.1). The workshop will cover and participants will receive materials on an overview of GIS and its use in everyday life, case study examples of GIS in the geosciences and mineral industries, sample geoscience GIS activities (earthquakes, geomorphology with ArcAtlas, U.S. regional landscapes and surface water), an overview of key geoscience GIS data sources and types, sample geoscience data retrievals and GIS application, free mapping software and several hundred megabytes of GIS data.

Limit: 15. Cost: \$10. Registration required. For information: George Dailey, (214) 599-0895, gdailey@esri.com; Ann Johnson, (909) 793-2853, ext. 1793, ajohnson@esri.com.

Using ArcView Extensions in Geoscience Education

Sunday, October 24, 1:00 p.m. to 5:00 p.m.

This workshop provides educators with hands-on experience with extensions designed for ArcView GIS 3.1, including ArcView Spatial Analyst and the Image Analysis Extension for ArcView. This set of tools augments ArcView's visualization and analysis capacity. Among other things, they allow users to work with digital elevation model (DEM) data, create surface and subsurface models, design and manipulate 3-D GIS renderings, and display and analyze remotely sensed data. The workshop "Introduction to GIS and ArcView for Geoscience Education" is recommended but is not a prerequisite.

Limit: 15. Cost: \$10. Registration required. For information: George Dailey, (214) 599-0895, gdailey@esri.com; Ann Johnson, (909) 793-2853, ext. 1793, ajohnson@esri.com; Mike Price, (909) 793-2853, ext. 1677, mprice@esri.com.

Earth Science Share-a-Thon, Educators and PEP Members Social Hour, and Rock Raffle

Monday, October 25, 4:00-5:30 p.m., Simultaneously

Early Career Faculty Session

Tuesday, October 26, 7:00-9:00 p.m.



Exhibits

Visit GSA's Web site, www.geosociety.org/meetings/99/exhibit1.htm to browse an on-line listing of exhibitors' products and services. For information on becoming an exhibitor, contact Tammy White, GSA Exhibits Manager, (303) 447-2020, ext. 141, twhite@geosociety.org.

Exhibitors as of May 12, 1999

Computer Software

EarthSoft
ERDAS, Inc.
ESRI (Environmental Systems Research Institute, Inc.)
Paleomap Project
Platte River Associates, Inc.
Research Systems, Inc.
RockWare, Inc.
Tasa Graphic Arts, Inc.

Educational Publishers (including state surveys)

Grand Canyon Association
Houghton Mifflin Company
Micropaleontology Press
National Research Council Canada—Research Press
New Mexico Bureau of Mines
Oxford University Press
Princeton University Press
Saunders College Publishing
University of Chicago Press

Gem and Mineral Dealers, Jewelry, and gifts

Cal Graeber/IKON Mining
Donald K. Olson Minerals
Gems & Crystals Unlimited
Howard Minerals
Komodo Dragon
Mineral Wells
Nature's Own
Prisma
Roxy Gemstone Jewelry

Geologic Supplies and Related Equipment

AMS, Inc.
ASC Scientific
Carolina Biological Supply Company
Estwing Manufacturing Company
Forestry Suppliers, Inc.

General Supply Corporation
J.L. Darling Corporation (Rite in the Rain)
Ward's Natural Science Establishment, Inc.

Geological Society of America

GSA Bookstore
GSA Coming Attractions
GSA Education, Outreach, and Policy Programs
GSA Foundation
GSA Geology and Public Policy Division
GSA Member Services
GSA Planetary Geology Division
GSA Professional Development

Government Agencies (Federal, State, Local)

Association of American State Geologists
Colorado Geological Survey
Kansas Geological Survey
NASA Aeronautics and Space Administration/Lyndon B. Johnson Space Center
NASA—The Global Change Master Directory
National Park Service
National Science Foundation
Oklahoma Geological Survey
U.S. Dept. of Energy—National Petroleum Technology Office
U.S. Geological Survey

Instrumentation, Cameras, and Scopes

Analytical Spectral Devices, Inc.
Bruker AXS, Inc.
Campbell Scientific Inc.
Finnigan MAT
Indus International, Inc.
JEOL USA, Inc.
Kratos Analytical, Inc.

CONVENIENT EXHIBIT HALL HOURS

Sunday, October 24	5:00 p.m.–7:30 p.m.
Monday, October 25	9:00 a.m.–5:30 p.m.
Tuesday, October 26	9:00 a.m.–5:30 p.m.
Wednesday, October 27	9:00 a.m.–5:30 p.m.
Thursday, October 28	Closed Except for GSA HQ Services (times below)

Meiji Techno America
Micromass
Rigaku/USA, Inc.
Scintag, Inc.
Sensors & Software Inc.
Solinst Canada Ltd.
SPEX CertiPrep., Inc.
Terraplus USA Inc.
UIC, Inc.

Other

American Ground Water Trust
Arc Science Simulations
Dorling Kindersley Family Learning
Geoprobe Systems
Incorporated Research Institutions for Seismology (IRIS)
JCPDS-ICDD
National Research Council/National Academy of Sciences
Philips Analytical
Subaru of America, Inc.
University Corporation for Atmospheric Research

Professional Societies and Associations

AAPG Bookstore
American Geological Institute
American Geophysical Union
American Institute of Hydrology
American Institute of Professional Geologists
American Quaternary Association
Association for Women Geoscientists (AWG)
Association of Engineering Geologists
Council on Undergraduate Research—Geology Division
Cushman Foundation
Economic Geology Publishing Company
Geochemical Society
Geoscience Information Society
Landscapes from Stone
Mineralogical Society of America
National Association of Geoscience Teachers (NAGT)
National Earth Science Teachers Association
Paleontological Research Institution
Paleontological Society

Rocky Mountain Association of Geologists
SEPM
Sigma Gamma Epsilon
Society of Economic Geologists

Publications, Maps, Films, and Teaching Aids

Academic Press
Blackwell Science, Inc.
Brooks/Cole Publishing
Cambridge University Press
Columbia University Press
Community of Science
Earth Observation Magazine
Elsevier Science Publishing Co.
John Wiley & Sons, Inc.
Kendall/Hunt Publishing Company
Kluwer Academic
Publishers/Plenum Publishing
McGraw-Hill
Mountain Press Publishing Co.
Prentice Hall
Rock Detective
Springer-Verlag
W.H. Freeman and Company
Yale University Press

Services (Exploration, Drilling, Laboratory, Consulting, etc.)

Activation Laboratories Ltd.
Geochron Labs/Krueger
Geologic Data Systems Inc.
Isotech Laboratories, Inc.
XRAL Laboratories

Universities and Schools

Baylor University
Brigham Young University
Colorado School of Mines
Desert Research Institute (DRI)
International Ground Water Modeling Center
Ohio State University
University of Alberta
University of Calgary
University of Nevada, Las Vegas
University of Nevada, Reno
University of Toronto
University of Wyoming
Wright State University

GSA Headquarter Services

In addition to the regular exhibit hall hours, the GSA Headquarter Services booths will also be open on **Thursday, from 9:00 a.m. to 2:00 p.m.**, to provide GSA members and meeting attendees an additional opportunity to access GSA services, staff, and publications.

- ◆ GSA Bookstore ◆ GSA Coming Attractions
- ◆ GSA Education, Outreach and Policy Programs ◆ GSA Foundation
- ◆ GSA Geology and Public Policy Committee ◆ GSA Member Services
- ◆ GSA Professional Development
- ◆ Check the on-site "Program" for opportunities to meet GSA's new Executive Director/CEO, Sara Foland!

Visit Us!



Monday, October 25 through
Wednesday, October 27,
Colorado Convention Center

Demo Theater

**Want to see the latest and greatest in
geological products and services?**

**Want to test drive the newest
geology-related computer software?**

Then you need to visit the Demo Theater where several exhibitors will present live demonstrations of their products and services. Don't miss out on special presentations like "CPT Logging Equipment" presented by Geoprobe and "Plate Tectonic Modeling Software" presented by PALEOMAP Project. Join RockWare for several presentations including "RockWorks98," "LogPlot98," and "An Introduction to the Geochemist's Workbench." Attendance is free, but space is limited.

A schedule of presentations and presenting companies will appear on the GSA Web site in September, in the September issue of *GSA Today* and in the on-site *Program*.

Exhibitors interested in participating in the Demo Theater should contact Tammy White, GSA Exhibits Manager, (303) 447-2020, ext. 141, twhite@geosociety.org.

New Publications in 1998-1999

GSA has 22 exciting new publications available for purchase at the GSA Bookstore at the Annual Meeting. These titles also are available through GSA phone (800-472-1988) and fax (303-447-1133) and on the GSA Web site (www.geosociety.org). Each edition will become a valuable addition to your personal geology library.



SPECIAL PAPERS

Argentine Precordillera

by Martin Keller

SPE341, In press, ISBN 0-8137-2341-8.
Publication date: July 1999

Mesozoic Sedimentary and Tectonic History of North Central Mexico

edited by Bartolini, Wilson, Lawson

SPE340, In press, ISBN 0-8137-2340-0.
Publication date: July 1999

Impact Cratering and Planetary Evolution II

edited by B. O. Dressler, V. L. Sharpton

SPE339, In press, ISBN 0-8137-2339-6.
Publication date: June 1999

Classic Concepts in Cordilleran Geology:

A View from California

edited by Eldridge M. Moores, Doris Sloan, Dorothy L. Stout, 1999

SPE 338, 500 p, indexed, ISBN 0-8137-2338-6,
\$97.85, Member price \$78.28
Publication date: June 1999

Glacial Processes Past and Present

edited by David M. Mickelson and John W. Attig

SPE337, 200 p, ISBN 0-8137-2337-X.
Publication date: June 1999

Laurentia-Gondwana Connections before Pangea

edited by Victor A. Ramos and J. Duncan Keppie

SPE336, 100 p, ISBN 0-8137-2336-1.
Publication date: June 1999

Tectonosomes and Olistostromes in the Argille Scagliose of the northern Apennines, Italy

by Gian A. Pini

SPE335, 73 p, ISBN 0-8137-2335-3.
Publication date: June 1999

Cenozoic Tectonics and Volcanism of Mexico

edited by H. Delgado-Granados, Gerardo

Aguirre-Diaz, Joanna M. Stock
SPE334, 164 p, ISBN 0-8137-2334-5.
Publication date: July 1999

Cenozoic Basins of the Death Valley Region

edited by Lauren A. Wright and Bennie W. Troxel

SPE333, 333 p, ISBN 0-8137-2333-7.
Publication date: June 1999

Evolution of the Cretaceous Ocean-Climate System

edited by Enriqueta Barrera and

Claudia C. Johnson

SPE332, 200 p, ISBN 0-8137-2332-9
Publication date: June 1999

Norumbega Fault System of the Northern Appalachians

edited by Allan Ludman and

David P. West, Jr.

SPE331, 214 p, ISBN 0-8137-2331-0,
\$55.00, Member price \$44.00

The Mid-Atlantic Piedmont: Tectonic Missing Link of the Appalachians

edited by David W. Valentino and

Alexander E. Gates, 1999

SPE330, 148 p, ISBN 0-8137-2330-2.
\$60.00, Member price \$48.00

Geologic Evolution of the Barberton Greenstone Belt, South Africa

edited by Donald R. Lowe and

Gary R. Byerly, 1999

SPE329, 324 p, indexed,
ISBN 0-8137-2329-9. \$60.00,
Member price \$48.00

Himalaya and Tibet: Mountain Roots to Mountain Tops

edited by Allison Macfarlane, Rasoul Sorkhabi,

Jay Quade, 1999

SPE328, 336 p, 1 large plate, indexed,
ISBN 0-8137-2328-0. \$70.00,
Member price \$56.00

Late Cenozoic Xianshuihe-Xiaojiang, Red River, and Dali Fault Systems of Southwestern Sichuan and Central Yunnan, China

by E. Wang, B. C. Burchfiel, L. H. Royden,

Chen Liangzhong, Chen Jishen, Li Wenxin, 1998

SPE327, 112 p, ISBN 0-8137-2327-2. \$41.00,
Member price \$32.80

Active Strike-Slip and Collisional Tectonics of the Northern Caribbean Plate Boundary Zone

edited by J. F. Dolan, P. Mann, 1998

SPE326, 186 p, indexed, ISBN 0-8137-2326-4.
\$60.00, Member price \$48.00

Depositional Environments, Lithostratigraphy, and Biostratigraphy of the White River and Arikaree Groups (Late Eocene to Early Miocene, North America)

edited by D. O. Terry, Jr., H. E. La Garry, R. M. Hunt, Jr., 1998

SPE325, 224 p, ISBN 0-8137-2325-6. \$69.00,
Member price \$55.20

Architecture of the Central Brooks Range Fold and Thrust Belt, Arctic Alaska

edited by J. S. Oldow, H. G. Ave Lallemand, 1998

SPE324, 330 p, ISBN 0-8137-2324-8. \$70.00,
Member price \$56.00

Accommodation Zones and Transfer Zones: The Regional Segmentation of the Basin and Range Province

edited by J. E. Faulds and J. H. Stewart, 1998

SPE323, 257 p, 1 color plate, ISBN 0-8137-2323-X. \$60.00, Member price \$48.00

MEMOIRS

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

edited by John C. Crowell, 1999

MWR 192, 70 p, In press. Publication date: June 1999

REVIEWS IN ENGINEERING GEOLOGY

Reviews in Engineering Geology XIII

Military Geology in War and Peace

edited by J. R. Underwood, Jr., P. L. Guth, 1998

REG013, 245 p, ISBN 0-8137-4113-0. \$76.00,
Member price \$60.80

MAPS/CHARTS

Fractures along a portion of the Emerson Fault Zone related to the 1992 Landers, CA Earthquake

Compiled by: Robert W. Fleming, et al.

MCH082, 20 p, 1 plate/sheet. \$19.00,
Member price \$16.00

The Blue Diamond Landslide

Compiled by: William R. Page, et al.

MCH083, 12 p, 1 plate/sheet. \$23.00,
Member price \$18.00

Geologic Map of Western Nicaraguan Highland, Central America

MCH084, 1 p, 1 plate/sheet. \$23.00,
Member price \$18.40



■ Electronic Publishing for STM Journal Publishers

Sunday, October 24, 1:00–5:00 p.m.

Sponsored by *Paleontological Research Institution* and *Allen Press, Inc.*

This workshop will feature five separate talks from experts at Allen Press devoted to issues surrounding electronic publishing in the sciences, from copyediting online to full-text journal publishing on the Web. Discussions of standards, models, and copyright issues will include demonstrations of copyediting software, CDs, and live online journal systems.

Limit: 200. No Fee. Registration required. See registration form on p. 31. For information: Roger Kaesler, University of Kansas, (785) 864-3338, kaesler@ukans.edu.

Institute for Earth Science and the Environment

■ IEE Annual Environmental Forum: The Sustainability Challenge II: Water in the 21st Century

Sunday, October 24, 1:00–5:00 p.m.

Convened by the *GSA Critical Issues Committee*.

Earth is called “the water planet” for a reason: liquid water is fundamental to life. Water of life-sustaining quality could easily become the primary limiting resource affecting the global human population in the next century. Indeed, this precious resource has shaped human history through wars large and small, mass human migrations and innumerable demographic shifts, and the distribution of wealth among individuals and nations. The IEE Annual Environmental Forum will examine water as potentially the most fundamental aspect of a sustainable global habitat for human beings.

■ Geology and Public Policy Forum: Creationism vs. Evolution in the Classroom: Should Geoscientists Make a Stand?

Wednesday, October 27, 1:30–3:30 p.m.

■ From the Outcrop to the Hill: Report from Kai Anderson, GSA 1998–1999 Congressional Science Fellow

Wednesday, October 27, 12:00–1:00 p.m.

■ Geology on Public Lands: A User's Guide for Scientists, Citizens, and Industry

Saturday, October 23, 9:00 a.m.–4:00 p.m.

Cosponsored by the *Institute for Earth Science and the Environment (IEE)*, the *Ecological Society of America*, and the *U.S. Geological Survey*.

Can your voice make a difference in how public lands and resources are managed? Do you know that a variety of “citizens’ processes” are available to you at several points in a land-use decision? That you can speak up during strategic planning for public lands management? When, and for what, do you need a permit? Would your institution benefit from a cooperative agreement with a National Park, or a cost-share agreement with a National Forest? Are there research opportunities going to waste because we aren't working together on public lands? These questions and many more will be addressed by the workshop leader and a panel of representatives from our co-sponsors. Take-home materials will include lists of useful contacts, decision-models, model contracts and agreements, and useful tips for optimizing your use of our public lands. A beer-based social event after the workshop will encourage potential partnerships between land managers and geoscientists.

Free to participants. Registration required on p. 31. For more information, contact workshop leader Cathleen May, GSA Headquarters, (303) 447-2020, ext. 195, cmay@geosociety.org.

■ Integrated Science Round Table: The Leadership Imperative

Monday, October 25, 9:30–11:30 a.m.

Cosponsored by the *Institute for Earth Science and the Environment (IEE)*, the *Ecological Society of America*, and the *U.S. Geological Survey*.

This roundtable is a follow-up to the November, 1998 cosponsored workshop on “Enhancing Integrated Science” as well as an opportunity for GSA members to participate in discussions about GSA's Integrated Science Initiative (Goal 2 of the GSA Strategic Plan). Please join us for your own interest, to provide feedback, and especially to generate concepts and ideas that will help us in our collaborative leadership roles.

■ Effective Expert Witnessing

Wednesday, October 27, 8:30 a.m.–4:30 p.m.

Full-day course cosponsored by the *National Groundwater Association*, *Institute for Earth Science and the Environment (IEE)*, and *GSA*. Course presented by Jack V. Matson, Ph.D.

The purpose of this one-day short course is to provide an in-depth understanding of the role of expert witnesses in litigation and how they can be effective. The examples used to illustrate points will be from court cases involving ground water and soils, and each segment will have an interactive audience participation portion. Real-life examples of courtroom testimony are presented, then dissected and analyzed. The legal system sorely needs competent, qualified experts who can deal with technical complexities in the courtroom. Being an expert witness in a court of law can be the most demanding, challenging, and exhilarating experience of your career.

Who Should Attend

- Geoscientists
- Geologists
- Geotechnical engineers
- Other technical specialists

Cost: \$385 for course plus full registration, \$325 for course plus one-day registration, \$285 course only.

Preregistration required; see registration form on p. 31.

For additional information on any of the special programs sponsored by the *Institute for Earth Science and the Environment (IEE)*, contact program coordinator Stacey Ginsburg, (303) 447-2020, ext. 194, sginsbur@geosociety.org or the Institute Director, Cathleen May, (303) 447-2020, ext. 195, cmay@geosociety.org.

Employment Service

Sunday, October 24, 12:00 noon–5:00 p.m., Monday, October 25 through Wednesday, October 27, 8:00 a.m.–5:00 p.m., Colorado Convention Center

Do you need qualified scientists to fill staff needs? Or are you looking for employment in the earth sciences? If so, you are invited to participate in the GSA Employment Interview Service. All organizations seeking qualified earth scientists are urged to submit notices of their vacancies and their requests for computer listings of applicants in advance of the meeting. Interview booths may be reserved at the meeting in half-day increments for a nominal fee. GSA staff will handle all interview scheduling with Employment Service applicants. Many job seekers have found the Employment Interview Service critical to their successful search for positions. The annual registration fee for applicants is \$35 for GSA members and associates, and \$65 for nonmembers. This fee provides year-round service, but also includes interviewing at the annual meeting. Students completing doctoral and master's theses during 1999 are particularly encouraged to join the Employment Matching Service and to check the job offerings at the meeting. Applicants who sign up with the Employment Matching Service by August 30, 1999, will have their information included in the materials that employers receive prior to the meeting, so submit your application form and résumé early to receive maximum exposure. Be sure to indicate on the form that you will be attending the meeting. For additional information or forms, contact Nancy Williams, Professional Development Department, GSA Headquarters, (303) 447-2020, profdev@geosociety.org, or see the Professional Development section on GSA's Web site at <http://www.geosociety.org>.

Employment Opportunities in the Geological Sciences

ROUNDTABLE DISCUSSIONS

Sunday, October 24, 1:00–3:00 p.m., Colorado Convention Center

This annual forum on employment opportunities in the geosciences allows valuable one-on-one interaction between panel members and individuals or small groups. Experts in each of the areas listed below will conduct his or her own “mini-roundtable” discussion designed to provide a better opportunity to field both general and specific questions on a more personal, individualized basis. These roundtable discussions will be in the Employment Service area during the interview registration time; however, *you do not have to be signed up for either the annual meeting or the Employment Matching Service to participate in these discussions.* Everyone—professionals and students—is encouraged to attend, to talk with as many of the experts as you like, and to pick up a free copy of the informational booklet, “Future Employment Opportunities in the Geological Sciences.” Roundtable discussion leaders from the following areas will be featured this year: Academic and Education, Mining, Federal Government, State and Local Government, Consulting, Petroleum, and Résumé Review. For additional information, contact Nancy Williams, Professional Development Department, GSA headquarters, (303) 447-2020, or profdev@geosociety.org.

ATTENTION STUDENTS!

PRESIDENT'S STUDENT BREAKFAST RECEPTION

Monday, October 25, 7:30–8:30 a.m., Colorado Convention Center

Sponsored by Exxon

GSA President Gail Ashley invites all the students registered for the meeting to attend a free breakfast buffet sponsored by Exxon. Gail and

members of the GSA Executive Committee, as well as Exxon staff members, will be on hand to answer questions and address student issues. Registered students will receive complimentary coupons redeemable toward the breakfast buffet, and will be eligible for prize drawings. Take this opportunity to network with fellow students and meet the officers of GSA!

GRADUATE SCHOOL INFORMATION FORUM

Sunday, October 24, 5:00–7:30 p.m. and Monday, October 25 through Wednesday, October 27, 9:00 a.m.–5:30 p.m., Colorado Convention Center, Hall A

STUDENTS: Make one trip to Denver to meet with representatives of 40–50 top graduate schools from around the country without spending the travel time and money to go to each school for information and interviews. A complete list of participating schools, with contact names and telephone numbers, is available by contacting Tammy White, GSA Exhibits Manager, (303) 447-2020, ext. 141, twhite@geosociety.org.

UNIVERSITIES: For your school name to appear in the September issue of *GSA Today* and the on-site *Program*, the deadline for reservations is August 6, 1999. Reservations received after this date will be accepted on a space-available basis and will not appear in either publication. If your school would like to reserve space, please contact Tammy White at the number or e-mail address above.

A schedule of participating schools will be published in the September issue of *GSA Today*.



Special Events

Exhibits Opening and Welcoming Party

Sunday, October 24, 5:00–7:30 p.m., Colorado Convention Center, Hall A

Join your colleagues to celebrate the grand opening kickoff for the 1999 GSA Annual Meeting and Exposition! This is the time to meet with friends and plan the next four days of networking and meeting activities. Relax and take this opportunity to view the exhibits and enjoy your favorite beverage.

Denver Museum of Natural History

Wednesday, October 27, 6:00–9:00 p.m.

Be a part of this special event as GSA tours the Denver Museum of Natural History. The evening includes round trip transportation, food voucher, and museum admission. Come and see the largest, most ambitious permanent exhibition in the Museum's 96-year history, **Prehistoric Journey**, which took more than six years to complete. Revealing the dynamic, 3.5-billion-year history of life on Earth, the exhibition includes 17,000 square feet of display space and features more than 500 fossils, 12 dinosaur skeletons, two fleshed-out dinosaur models, and a working fossil laboratory. Also of great interest to GSA members is the **Coors Mineral Hall**. Recently renovated, its newest permanent exhibit features the Alma King rhodochrosite crystal and a complete reconstructed vug of deep red translucent rhodochrosite crystals from the Sweet Home Mine in Alma, Colorado.

Cost: \$26 (includes transportation, dinner, museum admission and cash bar)

Special Events continued on p. 24



Tuesday, October 26,
7:00 p.m.–10:00 p.m.

Join GSA

for a wonderful
evening of socializing and

exploring at the newest world-class aquarium. Colorado's Ocean Journey not only features some of the world's most intriguing fish, it also houses tigers, otters and birds.

You'll encounter the sights, sounds, smells, temperature, and even humidity you'd expect to find in nature. You'll feel the sun's warmth as you walk past wind-sculpted sandstone, and you'll watch waves crash against a rocky beach. Walk through a bat cave into a misty tropical tangle of greenery. Meet riverfront predators, Bali and Java, the Sumatran tigers. Stand face to face with 10 species of sharks.

The Colorado River and Indonesia's Kampar River both begin their journeys at more than 12,000 feet and travel through magnificent diverse settings to reach their respective ocean destinies. Other major displays built around the one million gallons of fresh and salt water are the Sea of Cortez, Depths of the Pacific, and Sea Otter Cove.

Cost: \$43
(includes
transportation,
hors d'oeuvres,
wine and beer)

Please register early—this event is sure to sell out!

Special Events

Colorado Symphony and Dinner

Saturday, October 23, 5:30 p.m.

Guest conductor Miguel Harth-Bedoya of the Eugene, Oregon, Symphony will conduct "Under the Tuscan Stars," a concert of Verdi, Respighi, Lalo, and Mendelssohn. Buffet dinner before the concert. Both events in the Boettcher Concert Hall, Denver Performing Arts Center. Nancy Adams, Travel to Music, coordinator.

Limit: 50 people. Cost: \$70 (tickets are non-refundable)

Remembering Francis J. Pettijohn (1904-1999), by his Associates, Students, and Friends

Sunday, October 24, 3:00-5:00 p.m., Colorado Convention Center

Francis Pettijohn, who died this year at 95, was one of the 20th century's most influential sedimentary geologists. Join his associates, former students, and friends in remembering this unrepentant field geologist.

Awards Luncheons and Other Ticketed Group Functions

Associated societies and GSA divisions invite their members and other interested guests to join them for their annual meal functions, special addresses, and awards ceremonies. Only a few tickets will be available onsite, so please register early for ticketed functions using the preregistration form on page 31. Check the preregistration form for dates. Location and time of events will appear on your ticket and in the Annual Meeting Program.

GSA Presidential Address and Awards Ceremony

Monday, October 25, 5:45-7:45 p.m., Colorado Convention Center

The GSA Presidential Address and Awards Ceremonies will begin with President Gail M. Ashley's address, *Springs at Olduvai Gorge: Geologists Probe Hominid Environment*. A reception honoring the awardees will follow immediately.

- ◆ Penrose Medal—**M. Gordon Wolman**
- ◆ Day Medal—**Donald J. DePaolo**
- ◆ Young Scientist Award (Donath Medal)—**Peter C. Burns**
- ◆ GSA Distinguished Service Award—**Sue Beggs, Bill Bromery, Lynn Walter**
- ◆ Recognition will also be given to newly elected Honorary Fellows: **Albrecht W. Hofmann, Shunsho Ishihara**

Alumni Receptions

Monday, October 25, 7:00-9:30 p.m.

Plan to join your former classmates for an evening of memories and renewed connections. Cash bar receptions and hosted alumni parties are being planned for about 60 colleges and universities. Please see the 1999 Annual Meeting Program for locations of individual alumni receptions. If you would like to hold an alumni party, check with your department head, who may have already arranged this with GSA, or send an e-mail to Andrea Harshman, GSA Headquarters, aharshman@geosociety.org.



Guest Activities

Formal Tours

All GSA registered attendees are welcome to register for the tours offered as part of the Guest Program. Reservations for all tours will be accepted on a first-come, first-served basis. The tour operator requires a final guarantee several days in advance for most tours, and most tours have attendance minimums and maximums. Please register early to guarantee your spot. Tours may be canceled if minimums are not met. Plan to arrive at the hospitality room 15 minutes before the scheduled departure times for check-in.

Bird Watching at Rocky Mountain Arsenal

Sunday, October 24, 8:30 a.m.-1:00 p.m.

A member of the National Audubon Society will lead this tour through the Rocky Mountain Wildlife Refuge, which is the habitat for more than 300 species of wildlife, including 227 birds.

Cost: \$22 (includes transportation, Audubon Society guide)

Walking Through LoDo

Sunday, October 24, 1:00 p.m.-4:00 p.m.

Denver's most exciting revived area is in lower downtown—LoDo. It's upbeat, vital, and active with new restaurants, galleries, bookstores, Union Station, the Ice House, and Coors Field. Join us as we relive the early days and see the newest revived area of Denver.

Cost: \$10 (includes tour guide)

Springs Spectacles

Monday, October 25, 9:00 a.m.-5:00 p.m.

See the Seven Falls in South Cheyenne Canyon and the "Grandest Mile of Scenery in Colorado." Visit Old Colorado City, former Territorial Capital of Colorado, enjoy lunch on your own, and take time to browse in the many shops. Finish this Colorado Springs visit with a tour of the U.S. Olympic Training Complex.

Cost: \$29 (includes transportation, guide, and admission fees)

Hiking in Roxborough Park

Monday, October 25, 12:00 p.m.-4:00 p.m.

Wednesday, October 27, 9:00 a.m.-1:00 p.m.

This park west of Denver is the first to be designated both a Colorado Natural Area and a National Landmark. Spectacular rock formations, diverse animal habitats and tree-laden trails provide a variety of hiking opportunities. Trails are gentle to moderately steep and provide breathtaking views in all directions.

Cost: \$18 (includes transportation, guide, park admission and snacks)

Beneath the Flatirons

Tuesday, October 26, 9:00 a.m.-3:00 p.m.

Join us for a special outing in Boulder. First stop will be a guided tea tasting at Celestial Seasonings Tea Company, the largest herb tea manufacturer in the United States. Next will be the Leaning Tree Museum of Western Art, for a look at one of the largest privately owned collections of art of the American West. A stop on the pedestrians-only Pearl Street Mall will allow time for lunch on your own and browsing in the numerous shops and galleries.

Cost: \$21 (includes transportation and tour guide)

Millionaires, Mansions, and Memories

Tuesday, October 26, 12:00 p.m.-4:30 p.m.

Tour turn-of-the-century lifestyles in Denver including the famous Molly Brown House, unique and varied architecture of Millionaires' Row, and the Byers-Evans Mansion. Highlighting the day will be tea and pastries at the historic and eclectic Castle Marne.

Cost: \$42 (includes transportation, guide, admission fees, and tea at Castle Marne)

Flora, Fauna and Fossils

Wednesday, October 27, 9:00 a.m.–1:00 p.m.

The Museum of Natural History, the fifth largest museum of its kind in the United States, has over 70 dioramas displaying animals, anthropology, gem archaeology, insects, birds, mammals, and full-size skeletons of dinosaurs. We'll also visit the Denver Botanic Gardens for a guided tour of the 20-acre colorful gardens and the conservatory housing a tropical rain forest.

Cost: \$27 (includes transportation, guide and admission fees)

Brown Palace Tour and Afternoon Tea

Wednesday, October 27, 1:00 p.m.–3:00 p.m.

Come enjoy the ambiance of one of the country's most historic hotels. An historian will take you on a tour of the hotel and share the stories of the man who built it and the interesting personalities who have been guests from Presidents to a "pampered dog," to many famous entertainers. Following the tour high tea will be served on the mezzanine overlooking the atrium covered with Tiffany stained glass.

Cost: \$29 (includes historian and tea service)

Informal Tours

Denver has a great deal to offer, and the formal tours can cover only a small part of what is available to see. Please visit the Hospitality Room to ask hostesses for suggestions on more activities. You might enjoy self-guided tours with fellow guest attendees. Plan to sign up in the Guest Hospitality Room for informal, self-guided tours.

Air Travel

Get there for less! Conventions in America (CIA), GSA's official travel agent, has arranged special airline discounts for GSA attendees on United and American Airlines, or will provide the lowest available fare on any other airline.

American (AA) and United (UA)

- Save 5% on lowest applicable fares; some restrictions apply.
- Zone Fares save you money with no Saturday night stay; all rules apply.
- Take an additional 5% off with minimum 60-day advance purchase.
- Save 10% on unrestricted coach class fares, 7-day advance—United only.
- Travel between October 20 and November 2, 1999.

YOU HAVE THREE WAYS TO MAKE YOUR RESERVATIONS

1. Call the official GSA travel agency—Conventions In America, 1 (800) 929-4242 or (619) 232-4298; ask for GSA group #633 and receive:
 - lowest available fares on any airline
 - discounts on American and United
 - zone fares with no Saturday night stay
 - car rental discounts on Alamo
 - free flight insurance of \$100,000
 - frequent flyer miles and seat assignments
 - easy, E-ticket travel on most carriers
2. Call the airlines direct and ask for the following codes:
 - American Airlines 1 (800) 433-1790, Starfile #3809UG
 - United Airlines 1 (800) 521-4041, Tour Code #567JE
3. If using your own travel agency:

Please refer to the ID numbers above when booking on official carriers in order to receive special discounts. (Note: Zone fares on United are available only through United or Conventions in America.)

Guest Hospitality Room

Beginning on Saturday, October 23, guests are invited to visit the Hospitality Room located at the Colorado Convention Center. Your local hosts will provide a resource center with abundant information on Denver and the surrounding areas. Formal and informal tour information will be available. Light refreshments will be served throughout the day. Remember to wear your GSA badge; it will be required for admission to the Hospitality Room and the exhibit hall. Guest registration does not include access to the technical sessions. However, a guest can obtain a temporary pass to see a spouse or friend present a paper.

Guest Hospitality Room Hours

Sunday	8:00 a.m. – 4:00 p.m.
Monday	8:00 a.m. – 4:00 p.m.
Tuesday	8:00 a.m. – 4:00 p.m.
Wednesday	8:00 a.m. – 4:00 p.m.
Thursday	8:00 a.m. – 12:00 noon

Seminars

Payment of the guest registration fee entitles you to attend seminars that will be offered in the Guest Hospitality Room. Please see the Annual Meeting Program for more information on titles and times of the seminars.



Travel

Car Rental

Alamo is the official car rental company for the meeting. To receive Alamo's special group rates, attendees must call the toll-free 24-hour reservation number, 1 (800) 732-3232 and request Group ID# 85204 and Rate Code GR. International attendees may fax reservation requests to 1-954-769-4700. Discounts are on daily and weekly rates. Economy \$32/\$145, Compact \$36/\$155, Mid-size \$40/\$165, Full size \$43/\$185, Convertible \$56/\$285, Minivan \$56/\$289, Luxury \$67/\$365. Rates include unlimited mileage and no charge for additional drivers. The Alamo counter is outside the baggage claim area at Denver International Airport.

Conventions in America

1025 W. Laurel St., Suite 106, San Diego, CA 92101-1254, 1 (800) 929-4242, fax 619-232-6497, E-mail: flycia@scitravel.com, Web: www.scitravel.com (reference #633 when sending correspondence).

■ GSA Student Associate Member Travel Grants

The GSA Foundation has awarded \$4,000 grants to each of the six GSA sections. The money, when combined with equal funds from the sections, is used to assist GSA undergraduate Student Associates, as well as graduate Student Members, traveling to GSA meetings. For information and deadlines, contact your section secretary:

Cordilleran—	Bruce Blackerby, (209) 278-2955, bruceb@zimmer.csufresno.edu
Rocky Mountain—	Kenneth Kolm, (303) 273-3932, kkolm@mines.edu
North-Central—	Robert Diffendal, Jr., (402) 472-7546, rfd@unl.edu
Northeastern—	Kenneth Weaver, (410) 554-5532, kweaver438@aol.com
South-Central—	Rena Bonem, (254) 710-6806, Rena_Bonem@baylor.edu
Southeastern—	Harold Stowell, (205) 348-5098, hstowell@wgs.geo.ua.edu



Getting to Your Hotel

Airport Shuttles—Super Shuttle, 1-800-525-3177. Operates from DIA with service to and from downtown Denver. One way is \$17 and round-trip is \$27. Located on Level 5 in the center of DIA terminal. You will see their ticket counter on your way to the baggage claim area. Please identify that you are with GSA to receive the group discount rate.

RTD SkyRide—Convenient bus transportation from DIA to downtown Denver seven days a week. The service costs \$6 each way. For further information, call RTD at (303) 299-6000, or when you arrive at DIA, stop by the RTD Sale Counter in the Ground Transportation area on Level 5.

Taxicabs—Taxi service to and from the airport is available. Approximate cost from the airport to downtown is \$36–\$50 for one person.

Getting Around in Denver

GSA Shuttle—GSA will provide shuttle service between GSA hotels and the Colorado Convention Center. Most downtown Denver restaurants and hotels are a convenient walking distance from the Convention Center and from each other.

RTD Transit—There are several modes of public transportation in downtown Denver. RTD operates a free shuttle up and down the 16th Street Mall, the core of downtown Denver. In addition, the light rail provides convenient service for downtown offices, cultural centers, hotels, shopping, restaurants, and entertainment. Regular RTD buses also run throughout downtown and beyond. A daily pass good for either light rail or bus can be purchased for \$3 per day. For route and schedule information about RTD's light rail, 16th Street shuttle, or regular bus service, call (303) 299-6000 Monday through Friday, 6:00 a.m.–8:00 p.m. MST; weekends, 8:00 a.m.–8:00 p.m.

Taxicabs—Service within downtown Denver costs a minimum base charge starting at \$1.60 and \$1.60 each mile thereafter. Waiting time is \$0.30 per minute. Each additional passenger is \$0.40.



Accessibility for Registrants with Special Needs

GSA is committed to making the Annual Meeting accessible to all people interested in attending. If you need auxiliary aids or services because of a disability, check the appropriate box on the registration form. If you have suggestions or need further information, contact Andrea Harshman, GSA Headquarters, (303) 447-2020, ext. 158, aharshman@geosociety.org. Please let us know your needs by September 17.

Information, Messages, and Internet Services

Sunday through Thursday, Colorado Convention Center

The information and message desk at the Convention Center will be available to take messages on your behalf. Leave the following number for your home and office: (303) 228-8500.

Registered attendees will be able to access the Internet for message sending and retrieval. Browse the World Wide Web between sessions! These services are provided by GSA and conveniently located in the registration area.

News Room

Sunday through Thursday, Colorado Convention Center

The GSA News Room coordinates and assembles information on topics for release to the news media. Please stop by with material that is newsworthy for the science or general and local press.

Members of the press with appropriate credentials may request complimentary meeting registration by contacting Ann Cairns at GSA Headquarters, acairns@geosociety.org.

Child Care

Sunday through Thursday, Colorado Convention Center

The New Thomas Learning Centers of Colorado, approved and screened by the City and County of Denver, will be providing child care services during the meeting. This company is a Colorado-based, licensed, insured child care corporation with 22 years of experience. They employ thoroughly screened professionals to provide quality care to the children of convention attendees.

Costs are \$4.00/hour for children over the age of 3 years; toddlers and infants under the age of 3 are \$5.00/hour. **Preregistration by September 17, 1999, is recommended to secure appropriate staffing.** A deposit of \$35.00 per child is required with each reservation and will be applied directly toward your child care fee.

Parents are encouraged to contact the director at New Thomas Learning Center at (303) 344-8376 for further information and/or interviews.

For more information and/or a registration form, please contact Amanda Jimenez, GSA Headquarters, (303) 447-2020, ext. 239, e-mail, ajimenez@geosociety.org.

Tourist Information

Denver Metro Convention & Visitors Bureau
1555 California Street, Suite 300
Denver, CO 80202-4264
Telephone: (303) 892-1112
Fax: (303) 892-1636
Also visit their web site at www.denver.org

Weather and Climate

Fall weather in Denver is pleasantly similar to spring, with warm days and cool evenings. However, a visit to the mountains will generally require warmer clothing. Please remember, sun and/or snow are always possible! The average temperature for Denver in October is 52 degrees.

Prepare for the High Altitude

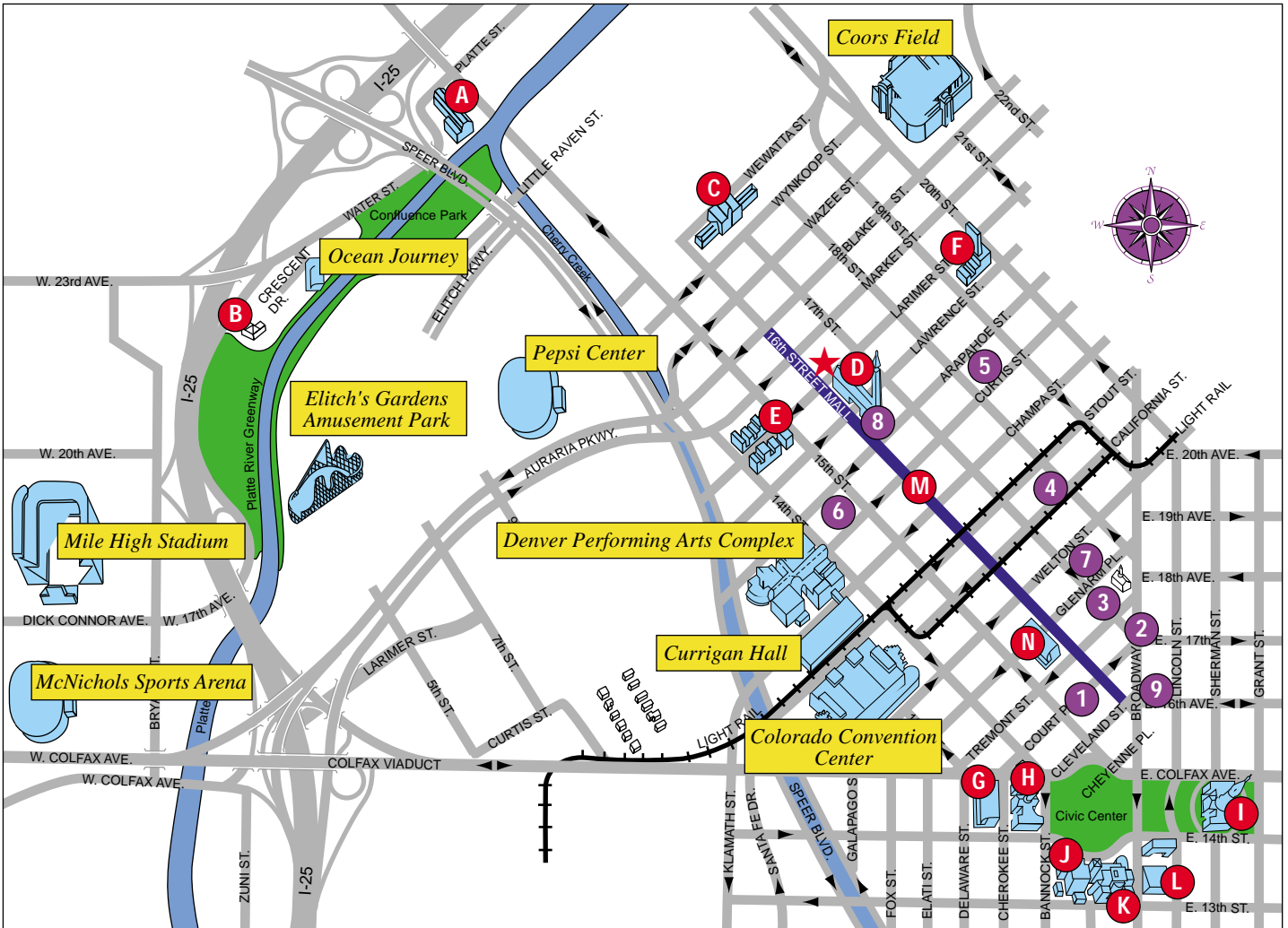
We want your stay in Denver to be productive and enjoyable. To avoid high altitude syndrome, please consider the following suggestions: drink plenty of liquids, avoid alcoholic beverages for the first 48 hours, eat lightly, and keep physical exertion to a minimum for the first two days.



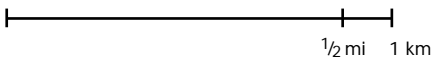
Downtown Denver

HOTELS

- | | | |
|---|---|---|
| 1 Adam's Mark
1550 Court Place | 4 Denver Marriott City Center
1701 California Street | 7 Hyatt Regency Denver
1750 Welton Street |
| 2 The Brown Palace Hotel
321 17th Street | 5 Embassy Suites Hotel
1881 Curtis Sreet | 8 The Westin Hotel Tabor Center
1672 Lawrence Street |
| 3 Comfort Inn Downtown
401 17th Street | 6 Holiday Inn Denver Downtown
1450 Glenarm Place | 9 YMCA
25 East 16th Avenue |



SCALE



- | | | |
|-------------------------|--------------------------|---------------------------|
| A Forney Train Museum | F Sakura Square | K Denver Public Library |
| B Children's Museum | G U.S. Mint | L Colorado History Museum |
| C Union Station | H City & County Building | M 16th Street Mall |
| D Tabor Shopping Center | I State Capitol | N Pavillions Shopping |
| E Larimer Square | J Denver Art Museum | ★ Visitor Information |

Housing

HOTEL	BLOCKS TO CONV. CENTER	RATES—SINGLE/DOUBLE	EXERCISE FACILITIES	RESTAURANTS	COMMENTS
Denver Marriott City Center 1701 California Street Co-Headquarters	3	\$129/\$146	Exercise Room/ Lap Pool	3	Downtown, business center, concierge, coffee makers, voice mail, data ports, hair dryer, irons/board, alarm clocks, laundry service.
Hyatt Regency Denver 1750 Welton Street Co-Headquarters	4	\$129/\$146	Exercise Room/ Indoor Pool	3	Downtown, concierge, coffee makers, voice mail, hair dryer, iron/board, data ports, laundry service, servi-bars.
Adam's Mark Hotel 1550 Court Place	4	\$129/\$129	Exercise Room/ Heated Outdoor Pool	6	Downtown, business center, coffee makers, voice mail, hair dryer, iron/board, laundry service.
The Brown Palace Hotel 321 17th Street	4	\$137 Standard-1 bed \$155 Superior-1 or 2 beds	Exercise Room	4	Downtown, four star, historic hotel. Business center, concierge, coffee makers, voice mail, hair dryer, iron/board, terry robes.
Comfort Inn Downtown 401 17th Street	4	\$92/\$102 Standard-1 bed \$112/\$112 Superior- 1 or 2 beds	Exercise Room	0	Downtown, complimentary continental breakfast, voice mail, modem telephone, iron/board, connected to Brown Palace.
Westin Hotel Tabor Center 1672 Lawrence Street	5	\$125/\$125	Exercise Room/ Racquetball Courts/Outdoor/ Indoor Pool	2	Downtown, connected to the Tabor Center, daily newspaper, coffee makers, mini-bar, speaker phone, voice mail, data port, hair dryer.
Holiday Inn Downtown 1450 Glenarm Place	1	\$83/\$93	Exercise Room/ Heated Outdoor Pool	1	Downtown, coffee makers, iron/board, data port, hair dryer.
Embassy Suites 1881 Curtis Street	6	\$137/\$137	Exercise Room/ Heated Outdoor Pool	2	Downtown, all suites, wet bar, coffee maker, refrigerator, microwave, complimentary breakfast and evening reception.
YMCA 25 East 16th Avenue	5	Varies; contact YMCA at (303) 861-8300	Exercise Room/ Indoor Pool	0	Student property—no children allowed; most rooms have shared bathrooms.

Note: Triple and quad occupancy rates are between \$10 and \$30 more per night. Shuttle Fee: A \$3.00 per night rebate is included in the hotel rate. The rebate will be used to subsidize the increasing costs of providing shuttle service for GSA Annual Meeting attendees.

Housing

The Denver Marriott City Center and Hyatt Regency will serve as co-headquarter hotels hosting business meetings, social events, and workshops. Eight hotels in Denver will be offering a special GSA convention rate. Please make reservations early to ensure there is room at your preferred hotel. Please see the hotel grid below for specific information and pricing on each hotel.

Making a Reservation

Please print or type all information on the housing form located on page 29. Mail or fax the form to the GSA Housing Bureau. Check all information for accuracy before sending. Hotel rooms will be assigned on a first-come, first-served basis. List your first four hotel choices. If the selected hotels are unavailable, the Housing Bureau will select a hotel based on your specified criteria. For best results return your form early. **THE RESERVATION CUT-OFF DATE IS SEPTEMBER 17, 1999.** The GSA convention rate cannot be guaranteed after this date.

You will receive an acknowledgement from the Housing Bureau with your hotel assignment within seven days of receipt of the housing form. *The Housing Bureau will not accept reservations by telephone.* If you have not received acknowledgement within seven days or need to cancel or change a reservation before September 17, call the Housing Bureau at (303) 892-1112, ext. 601. Changes to arrival or departure dates, name changes, and cancellations after September 17 must be made directly with the hotel. Please see your hotel confirmation for individual hotel cancellation and deposit refund policies.

Room Deposits

All reservations require a one-night room and 11.8% tax deposit. The hotel will charge your credit card for the deposit or you must send a check directly to the hotel upon receipt of the official housing acknowledgement. Please read the hotel confirmation carefully; it will state the cancellation and refund policy. **DO NOT SEND DEPOSIT CHECKS TO THE HOUSING BUREAU.**



Special Needs

The Americans with Disabilities Act ensures that barrier-free hotel rooms will be made available to GSA registrants. Those with special needs should specify this on the Housing Form. All properties being utilized by GSA have accessible rooms for the disabled. For inquiries about accessibility of a specific hotel, please contact Andrea Harshman, GSA Headquarters, (303) 447-2020, ext. 158.

Student Housing

A specific hotel has not been reserved for students. Students may reserve rooms at any of the listed properties using the housing form. Students may want to share a room to reduce housing costs.

The YMCA is a less expensive option for students. Rates range from \$29 to \$55. For further information and to reserve a room, please call the YMCA directly at (303) 861-8300. Do not use the Housing Form for reservations at the YMCA.

Housing Form

GSA Annual Meeting, October 25-28, 1999

MAIL TO: GSA Housing Bureau
1555 California Street, Suite 300
Denver, CO 80202-4264

or Fax: 303-571-9435
Highly Recommended

**Housing Deadline:
Friday, September 17**

(NO TELEPHONE RESERVATIONS WILL BE ACCEPTED.)

Please do not duplicate your reservation by faxing and mailing this form. Print or type all information. Please read all hotel information prior to filling out this form. Reservations are processed on a first-come, first-served basis. Please submit one room request per form. If more than one form is required, this form may be photocopied. Acknowledgments will be sent by fax or mail. Be sure to keep a copy for your records.

Please send acknowledgment by fax or mail to:
(acknowledgments faxed between 11 p.m.-4 a.m., Mtn Time)

First Name _____ M.I. _____ Last Name _____

Company Name _____

Mailing Address _____

City/State _____ ZIP Code _____ Country: _____

Area Code _____ Daytime Phone Number _____ Fax _____

Arrival Date: _____ Arrival Time: _____ a.m./p.m.

Departure Date: _____

HOTEL PREFERENCE: (Please see grid on Page 28 for participating hotels.)

1. _____
2. _____
3. _____
4. _____

If all hotels requested above are unavailable, please process my reservation form according to:

- Comparable Room Rate Proximity to Convention Center

TYPE OF ACCOMMODATION: (Please check required room type.)

- Single (1 bed, 1 person)
 Double (1 bed, 2 people)
 Double/Double (2 beds, 2 or more people)
 Triple (3 people, 2 dbl. beds)
 Quad (4 people, 2 dbl. beds)

SPECIAL NEEDS:

- Nonsmoking room Smoking room Special needs (please list) _____

PLACE RESERVATION IN NAME OF: _____
First name Last Name

Name all other occupants:

Share with: _____

Share with: _____

Share with: _____

CREDIT CARD INFORMATION FOR HOTEL:

- American Express VISA Mastercard Diners Club

Card No. _____ Exp. date _____

Print name as it appears on card _____

Authorized Signature _____

RESERVATION DEPOSIT:

All reservations require a deposit equal to one night's stay plus 11.8% tax. The hotel will charge your credit card based on information provided above or you may send a check directly to the hotel upon receipt of official housing acknowledgment. If deposit is not sent, your reservation will be canceled. The hotel confirmation will state the cancellation/refund policy; please read this carefully. DO NOT SEND DEPOSIT CHECKS TO HOUSING BUREAU.

Registration

BY MAIL:

GSA Annual Meeting
P.O. Box 9140
Boulder, CO 80301-9140

BY FAX

303-447-0648 or 303-447-1133
(available 24 hours)
Credit card use only.

Please do not send another copy in the mail.

All registration forms received at GSA by September 17 will be processed and badges mailed two weeks before the meeting.

GSA and ASSOCIATED SOCIETY MEMBERS SAVE \$50 (professional) and \$25 (student) with preregistration fees.

NONMEMBERS SAVE an additional \$50 (professional) and \$25 (student) by joining GSA now. See how to get your discount below.

Preregistration deadline:

September 17

Cancellation deadline:

September 24

The member fees apply to members of both GSA and Associated Societies (listed on the form).

Registrations will not be processed unless full payment is received. Unpaid purchase orders are NOT accepted as valid registration. The confirmation sent by GSA will be your only receipt. You should receive it within two weeks after your registration is submitted.

Badges are needed for access to ALL activities, 10:00 a.m. Sunday through 5:00 p.m. Thursday.

A **guest registration** fee is available for a nongeologist spouse or friend of a professional or student registrant and is required for those attending guest activities and the exhibit hall. The guest registration fee will not provide technical session access. Any guest wishing to see a specific talk should come to the Guest Hospitality Room for a pass.

Students: A CURRENT student ID is required to obtain student rates. You will have to pay the professional fee unless you have the ID.

Please register only one professional or student per form, and retain a copy for yourself.

All registrations received after September 17 will be considered ON-SITE registrations and charged accordingly. Absolutely no registrations should be mailed or faxed after October 1. After this date we will handle registrations at the Convention Center during the registration hours listed below.

On-site fees for GSA Short Courses are an additional \$30.

As a special consideration, GSA is offering a discount rate to our members who are 70 years of age and older. Please write your membership number in the space provided and be sure to bring a picture ID to ensure your discount.

Cancel lations, Changes, and Refunds

All requests for additions, changes, and cancellations must be made in writing and received by September 24, 1999. Faxes are accepted. GSA will refund or credit preregistration fees for cancellations received in writing by September 24. NO REFUNDS WILL BE MADE ON CANCELLATION NOTICES RECEIVED AFTER THIS DATE. Refunds will be mailed from GSA after the meeting. Refunds for fees paid by credit card will be credited according to the card number on the preregistration form. There will be NO refunds for on-site registration, *Abstracts with Programs*, and ticket sales.

On-Site Registration Schedule

Colorado Convention Center, Lobby A

Saturday, Oct. 23	7:00 a.m. to 4:30 p.m.
Sunday, Oct. 24	7:00 a.m. to 7:30 p.m.
Monday, Oct. 25	7:00 a.m. to 4:30 p.m.
Tuesday, Oct. 26	7:00 a.m. to 4:30 p.m.
Wednesday, Oct. 27	7:00 a.m. to 4:30 p.m.
Thursday, Oct. 28	7:00 a.m. to 11:00 a.m.

Members Pay Less! Join Now!

If you are not yet a GSA member, now is the time to join. Professionals save a substantial amount on their registration fee by paying the member rate—almost exactly the amount you'd pay to join GSA. *That's like joining GSA for free!* Likewise, students who pay the basic membership dues of \$20 to become a Student Member (graduate student) or Student Associate (undergraduate student) receive a \$20 discount on their Annual Meeting registration. Note: these discounts apply only to full-meeting paid registration—not to one-day or complimentary registrations. Also, you must complete a membership application form to receive this benefit.

Save time by joining before the meeting by contacting the Membership Services Department at (303) 447-2020, or member@geosociety.org. Information is also available under the Membership section on GSA's World Wide Web site at <http://www.geosociety.org>. During the meeting, membership application forms are available at the Member Services Booth in the Convention Center.



Registration Fees

	Advance—by 9/17/99		After 9/17/99
	Full Meeting	One Day	On-Site
Professional Member	\$220	\$136	\$270
Professional GSA Member (70 or older)	\$170	\$ 86	\$220
Professional Nonmember	\$270	\$161	\$320
Student Member	\$ 85	\$ 55	\$110
Student Nonmember	\$110	\$ 66	\$135
Guest or Spouse	\$ 80		\$ 80
K-12 Professional	\$ 30		\$ 40
Field Trip or Course Only	\$ 35		\$ 35

PREREGISTRATION FORM

DENVER

GSA ANNUAL MEETING • DENVER, COLORADO

October 25-28, 1999

Preregistration Deadline: **September 17**. Deadline for changes or cancellation is **September 24**.

Please print clearly • THIS AREA IS FOR YOUR BADGE

First Name/Nickname (as it should appear on badge) _____ Last Name _____ * Male Female

Employer/University (affiliation as it should appear on badge) _____

Mailing address Is this a permanent address? Yes No

City _____ State or Province _____ ZIP or Postal Code _____ Country _____
 E-mail _____ Business Phone _____ Fax _____ Home Phone _____

Spouse/Guest First Name/Nickname (as it should appear on badge) Last Name _____ * Male Female

Do you or your guest require any special considerations? Yes No

Will you be working in the exhibit hall? Yes No

For CEU credit — Social Security # _____

Check member affiliation (to qualify for registration member discount): (a) GSA Mbr # _____
 (b) AASG (c) AEG (d) AGID (e) AIPG (f) AWG (g) CF (h) CUR
 (i) GIS (j) GS (k) MSA (l) NABGG (m) NAGT (n) NESTA (o) PS
 (p) PRI (r) SEG (s) SGE (t) SVP (u) SEPM (v) AASP

REGISTRATION FEES (US\$)	Full Meeting	One Day	Qty.	US\$ Amount
Professional Member*	(10) \$220	(11) \$136	1	\$
Professional GSA Member (70 and over)	(12) \$170	(13) \$86	1	\$
Professional Nonmember	(14) \$270	(15) \$161	1	\$
Student Member*	(30) \$85	(31) \$55	1	\$
Student Nonmember	(32) \$110	(33) \$66	1	\$
K-12 Professional	(60) \$30		1	\$
Guest or Spouse	(90) \$80		1	\$
Field Trip or Short Course Only Fee	(01) \$35		1	\$

*Member fee applies to any current Professional OR Student Member of GSA or Associated Societies listed above. Discount does not apply to guest registrants. **Total Column A \$**

FAX TO: 303-447-0648 or 303-447-1133
MAIL TO: GSA ANNUAL MEETING,
P.O. BOX 9140
BOULDER, CO 80301-9140

Remit in U.S. funds
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Purchase Orders not accepted.)

Payment by (check one): Check American Express
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Card Number _____ Expires _____
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* Needed for field trip lodging.

GUEST ACTIVITIES (p. 24)

	Qty	Amount
1. Walking Through Lobo	(101) \$ 10	\$
2. Birdwatching	(102) \$ 22	\$
3. Spring Spectacles	(103) \$ 29	\$
5. Hiking in Roxborough Park	(104) \$ 18	\$
5. Beneath the Flatirons	(105) \$ 21	\$
6. Millionaires, Mansions.	(106) \$ 42	\$
7. Flora, Fauna, and Fossils	(107) \$ 27	\$
8. Brown Palace Tour	(108) \$ 29	\$

SPECIAL EVENTS (p. 23)

1. Colorado Symphony, Dinner	(201) \$ 70	\$
2. Ocean Journey	(202) \$ 43	\$
3. Denver Museum of Natural History	(203) \$ 26	\$

TICKETED GROUP FUNCTIONS (p. 24)

1. G&PP Breakfast, Sun.	(301) \$ 16	\$
2. Geosci. Ed. Div. Breakfast, Mon.	(302) \$ 16	\$
3. MAGT Lunch, Mon.	(303) \$ 25	\$
4. AWG Breakfast, Tues.	(304) \$ 16	\$
5. History Geol. Div. Lunch, Tues.	(305) \$ 25	\$
6. Hydrogeol. Div. Lunch, Tues.	(306) \$ 25	\$
7. MSA Lunch, Tues.	(307) \$ 25	\$
8. Paleont. Soc. Lunch, Tues.	(308) \$ 25	\$
9. SEG Lunch, Tues.	(309) \$ 25	\$
10. GIS Lunch, Tues.	(310) \$ 25	\$
11. MSAGS Recept., Prof., Tues.	(311) \$ 10	\$
12. MSAGS Recept., Student, Tues.	(312) \$ 5	\$
13. Eng. Geol. Div. Lunch, Wed.	(313) \$ 25	\$

SHORT COURSES (p. 16)

1. Practical Methods Appl Contaminant Geochemistry	Professional (501) \$175	\$
Student (501) \$155	\$	
2. Applied Inverse Ground Water Modeling	Professional (502) \$385	\$
Student (502) \$365	\$	
3. Digital Mapping Methods	Professional (503) \$385	\$
Student (503) \$365	\$	
4. Intro to Remote Sensing for Geological Applications	Professional (504) \$325	\$
Student (504) \$305	\$	
5. Modern Salt Tectonics	Professional (505) \$265	\$
Student (505) \$245	\$	
6. 3D Seismic Interpretation: A Primer for Geologists	Professional (506) \$280	\$
Student (506) \$260	\$	
7. Applications of Environmental Isotopes	Professional (507) \$275	\$
Student (507) \$255	\$	
8. Teaching Earth System History	Professional (508) \$175	\$
Student (508) \$155	\$	

Total Column B \$

FIELD TRIPS (p. 13)

	Qty	Amount
1. Cretaceous Hydrocarbon Plays	(401) \$290	\$
2. Heart Mountain Detachment	(402) \$375	\$
3. Hydrology & Wetlands	(403) \$80	\$
4. Coal Mining, 21st Century	(404) \$180	\$
5. K/T Boundary in Raton Basin	(405) \$180	\$
6. Front Range	(406) \$185	\$
7. 200,000 Yrs of Climate Change	(407) \$185	\$
8. Active Evaporite Tectonics	(408) \$80	\$
9. Bouncing Boulders	(409) \$65	\$
10. Cave of the Winds	(410) \$85	\$
11. Dinosaur Ridge	(411) \$70	\$
12. Kimberlites	(412) \$90	\$
13. G.G. Simpson's Neighborhood	(413) \$10	\$
14a/b. Denver Buildings	Monday (414A) \$10	\$
Wednesday (414B) \$10	\$	
15a/b. USGS Facilities	Tuesday (415A) \$15	\$
Wednesday (415B) \$15	\$	
16. Dinosaur Ridge	(416) \$70	\$
17. Laramide Minor Faulting	(417) \$85	\$
18. Rocky Flats	(418) \$90	\$
19. South Park	(419) \$80	\$
20. Cambrian-Ordovician	(420) \$240	\$
21. Gold Belt Byway	(421) \$175	\$

SPECIAL PROGRAMS (p. 22)

1. Electronic Pub. Workshop	(550) Free	\$
2. Geology on Public Lands	(551) Free	\$
3. Effective Expert Witnessing	Course plus Full Reg. (552) \$385	\$
Course plus 1-Day Reg. (553) \$325	\$	
Course only (554) \$285	\$	

K-16 WORKSHOPS (p. 18)

1. Dinosaurs and Resources	Field Trip (601) \$10	\$
2. USGS Educational Resources	(602) Free	\$
3. Teaching Undergraduate	Geoscience (603) \$20	\$
4. Plate Tectonics	(604) \$10	\$
5. Evolution: Investigating the Evidence	(605) \$20	\$
6. How to Get Started in Research	(606) \$20	\$
7. Inquiry Learning in Plate Tectonics	(607) \$20	\$
8. Solar System for Special Needs Kids	(608) \$20	\$
9. Intro to GIS and ArcView	(609) \$10	\$
10. Using ArcView Extensions	(610) \$10	\$
11. Share-a-thon Presenters Only	(611) Free	\$
12. Early Career Faculty Session	(612) Free	\$

Total Column C \$

TOTAL FEES REMITTED \$

1999 Annual Meeting

Abstracts Due July 12

Preregistration and Housing due September 17

(Registration and Housing forms enclosed)

Cancellation Deadline September 24

World Wide Web

Visit the GSA Web site for more details and to get the latest information on the Annual Meeting.

Divisions of GSA

The GSA Divisions enhance the Society's technical, scientific, and professional activities. Members are encouraged to participate in all Divisions in which they have an interest. The GSA Divisions are:

- Archaeological Geology ♦ Coal Geology ♦ Engineering Geology ♦ Geophysics
- ♦ Geoscience Education ♦ History of Geology ♦ Hydrogeology
- ♦ International ♦ Planetary Geology ♦ Quaternary Geology and Geomorphology
- ♦ Sedimentary Geology ♦ Structural Geology and Tectonics

Associated Societies

American Association of Stratigraphic Palynologists ♦ American Institute of Professional Geologists ♦ Association for Women Geoscientists ♦ Association of American State Geologists ♦ Association of Engineering Geologists ♦ Association of Geoscientists for International Development ♦ Council on Undergraduate Research—Geology Division ♦ Cushman Foundation ♦ Geochemical Society ♦ Geoscience Information Society ♦ Mineralogical Society of America ♦ National Association for Black Geologists and Geophysicists ♦ National Association of Geoscience Teachers ♦ National Earth Science Teachers Association ♦ Paleontological Research Institution ♦ Paleontological Society ♦ Sigma Gamma Epsilon ♦ Society for Sedimentary Geology ♦ Society of Economic Geologists ♦ Society of Vertebrate Paleontology

For More Information

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1999, Volume 31, Number 7

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Prepayment is required. Check, money order (in U.S. funds, payable on U.S. banks), or major credit cards are accepted. Order directly from GSA Publication Sales by mail, phone, or fax. To assure receipt prior to the meeting, all orders must be received by August 28.

By mail or fax, use the form provided. By phone, call toll-free 1-800-472-1988, or use our business phone (303) 447-2020 during office hours (8:00 a.m. to 4:30 p.m. MT). On the GSA Web site, www.geosociety.org.

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