

GSA TODAY

A Publication of the Geological Society of America

Abstracts Due July 7

Preregistration Must Be
Received By September 24


BOSTON

CHARGING INTO THE FUTURE

1993 ANNUAL MEETING

Boston, Massachusetts - October 25-28**John B. Hynes Convention Center - Boston Marriott Copley Place**

New England geologists are preparing a broad-based, enthusiastic welcome for GSA's Annual Meeting next October in Boston. The Annual Meeting Committee, from eight universities, several consulting firms, and secondary schools, has planned a meeting that is something like a Millennial Celebration. Its central focus, Geology and Health (or, as some say, "Rocks and Docs"), underscores the centrality of geological knowledge and education to discussions of human interactions with global and local environments.

Boston at any season is a highly stimulating scientific, academic, cultural, historic, business, gastronomic, and tourist paradise. The end of October, moreover, is the height of the foliage season, a magnificent time in New England for any outdoor interest, but especially for field trips and guest tours. On behalf of the Annual Meeting Committee and the geologists of the New England Intercollegiate Geological Conference, I am pleased to invite you to Boston and look forward to welcoming you to what we hope and expect will be one of the most significant and most enjoyable meetings of GSA in this millennium.

*Jim Skehan, S.J.**General Chairman, 1993 Annual Meeting Committee*

■ Early morning at Jenny Farm, Reading, Vermont. Photo by Paul Corkum.



GEOLOGICAL SOCIETY OF AMERICA

TABLE OF CONTENTS

Abstracts with Programs	171	Guest Program	163
Bravo Boston GSA Chorale	163	Lodging	166
Congressional Science Fellowship Program ..	162	Membership	171
Convenience Information	171	Professional Horizons—	
Diversions	163	GSA Continuing Education Courses,	
Education Programs for K–12 Teachers	162	Forums, Workshops	154
Employment Service	161	Registration	170
Exhibits	160	<i>Science Classroom of the Future</i>	172
Field Trips	147	Technical Program	143
Geology and Public Policy Forum	161	Top Seniors Program	161
Graduate School Information Forum	161	Travel	166

1993 ANNUAL MEETING COMMITTEE

General Chair	James W. Skehan, S.J.	Boston College
Co-Chair	O. Donald Hermes	University of Rhode Island
Combined Publishers'		
Display Coordinator	Cathy I. Gabis	TRC Environmental Corp., Lowell
Computer Technology Program		
Coordination Chair	Rudolph Hon	Boston College
Co-Chair	Alfredo Urzua	Boston College
Co-Chair	Thomas Vaughn	Arlington Public Schools
Co-Chair	Arthur Brownlow	Boston University
Education Programs		
Coordinator Chair	Margaret Thompson	Wellesley College
Co-Chair	Richard Staley	F. A. Day Junior High School
Environmental Coordination		
Chair	Maureen Hill-Collins	Haley & Aldrich, Cambridge
Co-Chair	Larry Dingman	University of New Hampshire
Field Trip Chair	John T. Cheney	Amherst College
Co-Chair	J. Christopher Hepburn	Boston College
Fund-raising Chair	John T. Humphrey	Haley & Aldrich, Cambridge
Co-Chair	Jutta Hager	Hager-Richter Geoscience Inc., Salem, New Hampshire
Special Display Chair	Farouk El-Baz	Boston University
Guest Program Chair	Patricia Tassia	Boston College
Co-Chair	Shirley Lynch	Boston College
Special Events Chair	James E. MacNeil	Concord Middle School
Co-Chair	Howard Dimmick	Stoneham High School
Student Assistants Chair	Malcolm D. Hill	Northeastern University
Co-Chair	Martin E. Ross	Northeastern University
Technical Program Chair	Heinrich D. Holland	Harvard University
Co-Chair	Teresa S. Bowers	Gradient Corporation, Cambridge

Appreciation

More than 100 volunteers associated with the universities and colleges in the New England area have been involved in the planning and development of the 1993 Annual Meeting. Geologists giving personal and professional time to such a major undertaking are always appreciated at GSA. We particularly wish to recognize the wholehearted support of J. Donald Monan, S.J., President of Boston College, the major administrators and staff of Boston College's Office of Information Technology, and especially Clayton "Jeff" Jeffers, Director, Network Services, and Rodney J. Feak, Director, Computer Center for their support of the *Science Classroom of the Future* and the Computer Technology Program. We also wish to acknowledge the assistance of C. Peter Olivieri, Director, and T. Scott Kinder, Assistant Director, Instructional Research and Development Laboratory, a special department established by William B. Neenan, S.J., Academic Vice President. We wish to recognize also the New England Intercollegiate Geological Conference for assisting in the invitation to host the Boston meeting and for its ongoing support of professional and student field trips.

Contributors and Sponsors

For the Boston Annual Meeting, many corporations have contributed to a general fund or to specific events and exhibits. GSA is most appreciative of this support and thanks the following companies and individuals (at press time):

Fisons Instruments	PCR Computer Rentals, Boston	Haley & Aldrich, Inc.
John Wiley & Sons, Inc.	Redwing Environmental Tech	Geo Logic, Inc.
Stone & Webster Engineering Corporation	Rizzo Associates, Inc.	Shannon & Wilson, Inc.
	Con-Tec, Inc.	

Science Classroom of the Future sponsors are listed on page 172.

GSA TODAY (ISSN 1052-5173) is published monthly by The Geological Society of America, Inc., with offices at 3300 Penrose Place, Boulder, Colorado. Mailing address: P.O. Box 9140, Boulder, CO 80301-9140, U.S.A. Second-class postage paid at Boulder, Colorado, and at additional mailing offices. **Postmaster:** Send address changes to *GSA Today*, Membership Services, P.O. Box 9140, Boulder, CO 80301-9140.

Copyright © 1993, The Geological Society of America, Inc. (GSA). All rights reserved. Copyright not claimed on content prepared wholly by U.S. Government employees within the scope of their employment. GSA grants permission to individual scientists to make unlimited photocopies of the refereed science article(s) in this publication for noncommercial purposes advancing science or education, including classroom use, and permission is granted to individuals to make photocopies of those science articles for other noncommercial, nonprofit purposes upon payment of the appropriate fee (\$1.00 per article plus \$0.25 per page) directly to the Copyright Clearance Center, 27 Congress Street, Salem, Massachusetts 01970, phone (508) 744-3350 (include title and ISSN when paying). Permission is granted to individuals to photocopy freely the informational items in this publication. Written permission is required from GSA for all other forms of capture or reproduction of any item in this publication including, but not limited to, all types of electronic or digital scanning or other digital or manual transformation of articles or any portion thereof, such as abstracts, into computer-readable and/or transmittable form for personal or corporate use, either non-commercial or commercial, for-profit or otherwise. GSA provides this and other forums for the presentation of diverse opinions and positions by scientists worldwide, regardless of their race, citizenship, gender, religion, or political viewpoint. Opinions presented in this publication do not reflect official positions of the Society.

SUBSCRIPTIONS for 1993 calendar year: **Society Members:** *GSA Today* is provided as part of membership dues. Contact Membership Services at (800) 472-1988 or (303) 447-2020 for membership information. **Nonmembers & Institutions:** \$40 for U.S., Canada, and Mexico; \$50 elsewhere. Contact Subscription Services (same phones). **Single copies** may be requested from Publication Sales. Also available on an annual CD-ROM, and in an annual, hardbound, library edition; for prices and details contact Subscription Services or Membership Services. **Claims:** For nonreceipt or for damaged copies, members contact Membership Services; all others contact Subscription Services. Claims are honored for one year; please allow sufficient delivery time for overseas copies.

STAFF

Prepared from contributions from the GSA staff and membership.
Executive Director: F. Michael Wahl, Ph.D.
Science Editor: Eldridge M. Moores
Department of Geology, University of California, Davis, CA 95616
Forum Editor: Bruce F. Molnia
U.S. Geological Survey, MS 917, National Center, Reston, VA 22092
Managing Editor: Faith Rogers
Production & Marketing Manager: James R. Clark
Production Editor and Coordinator: Joan E. Manly
Graphics Production: Rochelle R. Blumenstein

ADVERTISING

Classifieds and display: contact Ann Crawford (303) 447-2020; fax 303-447-1133

Printed with pure soy inks in the U.S.A.

Associated Societies

- Association of Geoscientists for International Development
- Association for Women Geoscientists
- Cushman Foundation*
- Geochemical Society*
- Geoscience Information Society*
- Mineralogical Society of America*
- National Association of Black Geologists and Geophysicists
- National Association of Geology Teachers*
- National Earth Science Teachers Association
- Paleontological Society*
- Sigma Gamma Epsilon
- Society of Economic Geologists*
- Society of Vertebrate Paleontologists

*Representatives serve on the 1993 Joint Technical Program Committee

TECHNICAL PROGRAM



GSA Institute for Environmental Education (IEE) Annual Environmental Forum


A Crisis in Waste Management, Economic Vitality, and a Coastal Marine Environment: Boston Harbor and Massachusetts Bay.

Cosponsored by the *Geology and Public Policy Committee*

Sunday, October 24, 1:30 p.m. to 5:30 p.m.; Hynes Convention Center.

The IEE, in cooperation with the GSA Geology and Public Policy Committee, will sponsor its second Annual Environmental Forum on Sunday afternoon. The forum will examine the sometimes conflicting science, policy, economic, and legal issues surrounding the cleanup of Boston Harbor, one of the most polluted in the nation.

As part of a court-mandated plan to clean up the harbor, sludge is no longer discharged into it, and by 1995 sewage effluent will be discharged through a new ocean outfall into Massachusetts Bay. The public has demanded the cleanup of Boston Harbor, yet groups challenge the wisdom of the solution. Scientists have worked to assess the effect of the new outfall in the face of the uncertainty inherent in a complex coastal marine system. Recent scientific studies have been undertaken to provide a better understanding of the fate and effect of contaminants in this system, and a long-term monitoring program is under way to document environmental change.

In addition to the Forum, the IEE is cosponsoring several technical programs with GSA's divisions and the Geology and Public Policy Committee. These are identified with the global symbol .

Conveners: Bradford Butman and Frank Manheim, U.S. Geological Survey, Woods Hole, and Herman Karl, U.S. Geological Survey, Menlo Park.

Bradford Butman

Branch of Atlantic Marine Geology, USGS

Introduction to Boston Harbor and Massachusetts Bay

Michael S. Connor

Massachusetts Water Resources Authority

Contaminants in Boston Harbor and the Economic Consequences

Keith Stolzenbach

University of California, Los Angeles

Transport and Fate of Contaminants in Boston Harbor and Massachusetts Bay

Peter Shelley

Conservation Law Foundation

History of Litigation Forcing the Boston Harbor Cleanup

Mary Loebig

Stop the Outfall Pipe (STOP)

Challenges to the Boston Harbor Cleanup Plan: Part I

Robert Buchsbaum

Massachusetts Audubon Society North

Challenges to the Boston Harbor Cleanup Plan: Part II

John Teal

Woods Hole Oceanographic Institution

Alternatives to Secondary Treatment and Ocean Disposal: Part I

Susan Murcotte

Massachusetts Institute of Technology

Alternatives to Secondary Treatment and Ocean Disposal: Part II

Jerry Schubel

State University of New York at Stony Brook

National Perspectives on Waste Treatment and Ocean Disposal

The formal presentations will be followed by a panel and audience discussion. Panel members will include several of the speakers and representatives from the Massachusetts Port Authority, Massachusetts Office of Coastal Zone Management, Association for the Preservation of Cape Cod, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, and U.S. Geological Survey.



Call for Papers and Announcement of Symposia and Theme Sessions

ABSTRACT DEADLINE FOR INVITED AND VOLUNTEERED PAPERS—WEDNESDAY, JULY 7

Technical sessions consist of both invited and volunteered papers organized in one of three presentation formats: symposia, theme sessions, and discipline sessions. *All abstracts are due for review by July 7.*

On August 6–7 the Joint Technical Program Committee (JTTC) will select abstracts and determine the final schedule of sessions. The JTTC consists of approximately 40 geoscientists representing each of the associated societies and GSA divisions participating in the technical program.

<i>Abstract deadline</i>	July 7
<i>JTTC schedules abstracts</i>	August 6–7
<i>Acceptance notices mailed</i>	August 18
<i>Speaker information mailed</i>	August 20
<i>Full technical program schedule appears in GSA Today</i>	September 1

PRESENTATION MODES

Papers may be presented in one of two modes:

Oral—This is a verbal presentation before a seated audience. The normal length of an oral presentation is 15 minutes, including time for discussion. Projection equipment consists of two 35 mm projectors, one overhead projector, and two screens.

Poster—Approximately 40% of volunteered papers are presented in poster mode. Each poster-session speaker is provided with three horizontal, free-standing display boards approximately 8' wide and 4' high. The speaker must be present for at least two of the four presentation hours.

Papers for discipline sessions may be submitted in either oral or poster mode.

Papers for theme sessions are to be submitted in oral mode only, except for T2, T21, and T35. If the abstract is submitted in the incorrect mode, the abstract will NOT be considered for the theme session, but will automatically be considered for a discipline session instead.

1993 POSTER SESSION AWARDS

GSA will be sponsoring a best poster award daily after each morning and afternoon session. Entries will be judged on the basis of scientific content, clarity, coherence, and graphics. Specific guidelines will be mailed to poster authors in their speaker kits in late August. Winners' names will be posted daily and will appear in a future issue of GSA Today.

ABSTRACT FORMS

All abstracts must be submitted on the **1993 Abstract Form**, available from the Abstracts Coordinator at GSA headquarters, from the conveners of symposia, from the geoscience departments of most colleges and universities, and from the main federal and state survey offices. The abstract form will be used as camera-ready copy for publication of *Abstracts with Programs*.

SPEAKER-AUTHOR LIMITATIONS

Because of scheduling limitations, submit only one volunteered abstract as speaker or poster presenter for discipline and/or theme sessions. Multiple submissions as speaker-presenter for volunteered abstracts may result in rejection of ALL your abstracts. Note that this limitation does not apply to, nor does it include, invited contributions to symposia.

Invited Papers (Symposia)

This format includes only abstracts that have been invited by the convener of a symposium. Abstracts are to be sent directly to the convener by July 7. The convener is responsible for obtaining two independent reviews of each abstract, and for sending the reviews and the abstracts to GSA headquarters prior to the JTTC meeting.



Resistant sandstones capping waterfall at Kaaterskill Clove, New York. Middle Devonian river channel sandstones of Catskill sequence; Catskill Mountains. Photo by Richard H. Bailey.

S1. Geology and Health: 1993 Keynote Symposium.

Monday, October 25, 8:00 a.m. to 12:00 noon;
Hynes Convention Center.

The health of humanity requires adequate natural resources and a benign environment. Achieving these requirements will depend heavily on advances in the geological sciences. The human family will need new insights, new techniques, and solutions to a wide range of local, regional, and global problems. Several symposia and theme sessions will focus on these issues.

Leading off the theme on Monday morning will be a special Keynote Symposium sponsored by the Boston Annual Meeting Committee and organized by Heinrich D. Holland, Harvard University, and Teresa S. Bowers, Gradient Corporation, Cambridge, Massachusetts. The science and practice of geology have contributed a great deal to the health of mankind. They are also responsible for several environmental hazards. During the next century the connection will become progressively closer and more important, both for our science and for humanity as a whole. The symposium addresses some of the current environmental threats to human health and assesses the likely changes in their intensity during the coming decades.

Heinrich D. Holland
Harvard University
Introduction

James G. Anderson
Harvard University
Health Implication of Atmospheric Change

John A. Cherry
University of Waterloo, Canada
Ground-Water Contamination

H. Catherine W. Skinner
Yale University
Minerals as Health Hazards

Igor L. Khodakovskiy
Vernadsky Institute, Moscow, Russia
Nuclear Contamination and Human Health

Cyril Ponnampereuma
University of Maryland
Geochemical Aspects of Health in the Developing World

Howard Hu, M.D.
Harvard School of Public Health
From Dirt to Disease: A Physician-Epidemiologist's Perspective

The day and time shown after each symposium are tentative. The final schedule will be available after August 7 and will appear in the September issue of *GSA Today*.

- S2. **Fractal Geometry and Chaos Theory and Their Use in the Earth Sciences.**
Wednesday, October 27, morning. *Engineering Geology Division*. Christopher C. Barton, U.S. Geological Survey, Denver; Paul R. LaPointe, Golder Associates, Inc., Redmond, Washington; Alberto Malinverno, Schlumberger-Doll Research, Ridgefield, Connecticut.
- S3. **Geological Insight and Ground-Water Modeling.**
Monday, October 25, morning. *Hydrogeology Division*. Kenneth Belitz, Dartmouth College; Leonard F. Konikow, U.S. Geological Survey, Reston.
- S4. **The Permian-Triassic Mass Extinction: Causes and Consequences.**
Tuesday, October 26, morning. *Paleontological Society*. David J. Bottjer, University of Southern California.
- S5. **Fluids and Fluid Flow in the Crust.**
Sunday, October 24, afternoon. *Geochemical Society*. Susan L. Brantley, Pennsylvania State University; Barbara L. Dutrow, Louisiana State University.
- S6. **Inferring Paleearthquakes from Fault-Rock Fabrics: Experimental and Field Evidence.**
Monday, October 25, afternoon. *Structural Geology and Tectonics Division*. Frederick M. Chester, St. Louis University; Ronald L. Bruhn, University of Utah.
- S7. **Coalification: Metamorphic Parameters and Interpretation of Maturation Histories.**
Monday, October 25, morning. *Coal Geology Division*. Alan Davis, Pennsylvania State University; Paul C. Lyons, U.S. Geological Survey, Reston.
- S8. **Sedimentological and Stratigraphic Framework of Ground-Water Resources.**
Monday, October 25, afternoon. *Sedimentary Geology Division, SEPM (Society for Sedimentary Geology)*. Gordon S. Fraser, Indiana Geological Survey; Mary P. Anderson, University of Wisconsin—Madison.
- S9. **Neogene and Quaternary Sea-level Change and Coastal Plain Evolution: U.S. East Coast.**
Wednesday, October 27, afternoon. *Quaternary Geology and Geomorphology Division*. Thomas W. Gardner, Pennsylvania State University; Peter C. Patton, Wesleyan University.
- S10. **Organics and Ore Deposits.**
Sunday, October 24, all day. *Society of Economic Geologists, International Geological Congress*. Thomas H. Giordano, New Mexico State University.
- S11. **Geochemical Aspects of Minerals in Physiological Fluids.**
Monday, October 25, afternoon. *Mineralogical Society of America*. George Guthrie, Los Alamos National Laboratory.
- S12. **Sedimentary Diagenesis of Nitrogen and Sulfur in Organic Matter.**
Sunday, October 24, all day. *Organic Geochemistry Division of the Geochemical Society*. Robert I. Haddad, Unocal Corporation, Brea, California; Marty B. Goldhaber, U.S. Geological Survey, Denver.
- S13. **Evolution and Global Consequences of the Himalayan Orogenic System.**
Monday, October 25, morning. *International Division*. Kip V. Hodges, Massachusetts Institute of Technology.
- S14. **Deep Seismic Imaging across Continental Margins: From the Ocean-Continent Boundary to the Beach and Beyond.**
Wednesday, October 27, morning. *Geophysics Division*. Simon L. Klemperer, Stanford University; W. Steven Holbrook, Woods Hole Oceanographic Institution, Massachusetts.
- S15. **Human Problems, Foraminiferal Solutions.**
Tuesday, October 26, morning. *Cushman Foundation*. Jere H. Lipps, University of California, Berkeley; David B. Scott, Dalhousie University, Halifax, Nova Scotia.
- S16. **The First Half-Billion Years in the Inner Solar System.**
Tuesday, October 26, morning. *Planetary Geology Division*. George E. McGill, University of Massachusetts.
- S17. **Chlorine and Fluorine as Monitors of Fluid-Rock Interaction: New Developments.**
Thursday, October 28, morning. *Geochemical Society, Mineralogical Society of America*. Jean Morrison, University of Southern California; James L. Munoz, University of Colorado.
- S18. **Historical Research as a Function of Exploration Methodology.**
Tuesday, October 26, afternoon. *History of Geology Division*. Samuel T. Pees, Samuel T. Pees and Associates, Meadville, Pennsylvania.

- S19. **Analytical Methods in Archaeological Geology.**
Tuesday, October 26, afternoon. *Archaeological Geology Division.*
Henry P. Schwarcz, McMaster University, Hamilton, Ontario.
- S20. **Beyond Student Literacy: How to Create an Earth-Literate Public**
Monday, October 25, afternoon. *Geoscience Education Division.*
Dorothy L. Stout, Cypress College, California.
- S21. **Successfully Funded Laboratory and Field Technique Programs in the Geosciences.**
Tuesday, October 26, morning. *National Association of Geology Teachers, National Science Foundation.* Brian B. Tormey, Pennsylvania State University; Susan Hixson, National Science Foundation.
- S22. **Finding and Communicating Geoscience Information.**
Tuesday, October 26, morning. *Geoscience Information Society.*
Constance S. Wick, Harvard University.
- S23. **Metamorphic and Metamorphosed Ore Deposits.**
Monday, October 25, afternoon. *Society of Economic Geologists.*
Half Zantop, Dartmouth College.

Volunteered Papers

This format includes all abstracts that are not specifically invited for a symposium. Each paper will have a minimum of three reviews. Two types of sessions are available:

1. DISCIPLINE SESSIONS

Papers are submitted to one scientific discipline. The JTPC representatives select and schedule the papers in sessions focused on this one discipline, e.g., hydrogeology, geochemistry. Papers will be organized into sessions after the abstracts deadline. Please submit papers to the discipline of your choice.

2. THEME SESSIONS

Papers are submitted to a specific pre-announced title and to ONE scientific discipline. Theme sessions are interdisciplinary; each theme may have as many as three disciplines from which authors may choose ONE. After each theme description below, the disciplines are identified by name and number as they appear on the **1993 Abstract Form**.

Theme submissions must include:

- the theme number (e.g., T11),
- five key words of the theme title (e.g., Environmental Geology: Voice of Reason),
- one category (e.g., Environmental Geology—#6 on abstract form).

Papers for theme sessions are to be submitted in oral mode only, except for T2, T21, and T35. If the abstract is submitted in the incorrect mode, the abstract will NOT be considered for the theme session, but will automatically be considered for a discipline session instead.

Each theme session has been proposed by an advocate. *Advocates may not invite speakers; however, advocates may encourage colleagues to submit abstracts, with the understanding that there is no guarantee of acceptance.*

All abstracts will receive three peer reviews in the discipline for which they are submitted; a fourth review will be provided by the theme advocate.

If an abstract is not accepted for a theme session, it will continue through the evaluation process to be considered for the appropriate discipline session.

During the August 6–7 JTPC meeting, the designated JTPC representative (in consultation with the theme advocate) will organize theme sessions from the abstracts approved for presentation.

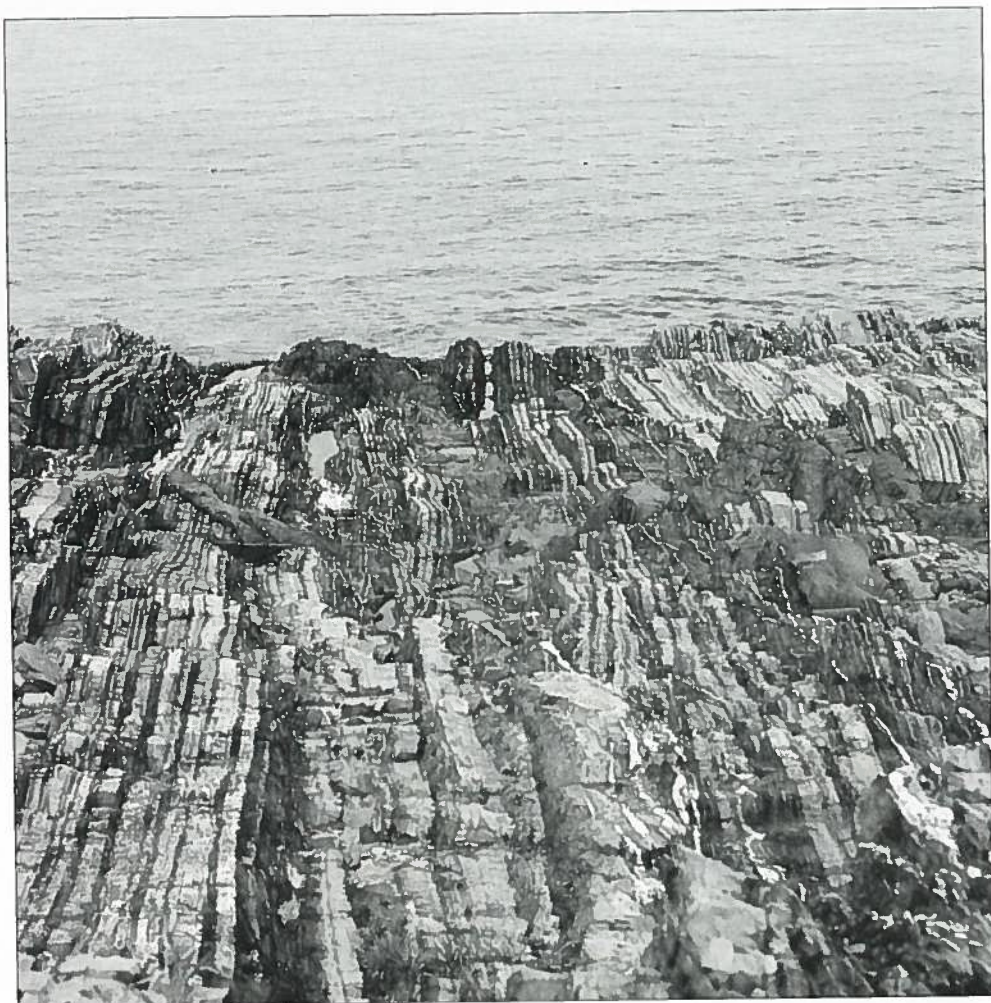
Schedules for theme sessions will be available immediately after the JTPC meeting and will appear in the September issue of *GSA Today*.

Theme Topics

- T1. **Fractal Geometry, Self-Organized Criticality, Chaos Theory, and Their Application in the Earth Sciences.**
Engineering Geology Division. Christopher C. Barton, U.S. Geological Survey, Denver; Paul R. LaPointe, Golder Associates, Inc., Redmond, Washington; Alberto Malinverno, Schlumberger-Doll Research, Ridgefield, Connecticut.
- This session is coordinated with the GSA short course *Fractals and Their Use in Earth Sciences*, which is part of the meeting on October 29–30. Engineering Geology (5).




- T2. **Tectono-metamorphic Evolution of North and Central America. POSTERS ONLY**
Rob Berman, Geological Survey of Canada, Ottawa, Ontario. Petrology, Metamorphic (22), Structural Geology (30), Tectonics (31).
- T3. **Teaching Mineralogy.**
Mineralogical Society of America. John B. Brady, Smith College, Northampton, Massachusetts; Jo Laird, University of New Hampshire. Geology Education (9), Mineralogy/Crystallography (16).
- T4. **Coalification: Metamorphic Parameters and Interpretation of Maturation Histories.**
Coal Geology Division. Alan Davis, Pennsylvania State University; Paul C. Lyons, U.S. Geological Survey, Reston. Coal Geology (2), Geochemistry, Aqueous/Organic (7), Mineralogy/Crystallography (16).
- T5. **Geochemistry of Large Rivers.**
John M. Edmond, Massachusetts Institute of Technology. Environmental Geology (6), Geochemistry, Other (8), Hydrogeology (13).
- T6. **Geologic Impacts of the Gulf War.**
Farouk El-Baz, Boston University; Ali Al-Shamlan, Kuwait Foundation for the Advancement of Science, Kuwait. Environmental Geology (6), Marine Geology (14), Quaternary Geology/Geomorphology (25).
- T7. **Hydrogeochemistry Related to Health and Disease.**
Hydrogeology Division, Institute for Environmental Education. Gerald L. Feder and Edward R. Landa, U.S. Geological Survey, Reston. Environmental Geology (6), Geochemistry, Aqueous/Organic (7), Hydrogeology (13).
- T8. **The Urban Ocean Environment: Geological Perspectives.**
Sedimentary Geology Division, SEPM (Society for Sedimentary Geology). Michael E. Field, U.S. Geological Survey, Menlo Park; Bradford Butman, U.S. Geological Survey, Woods Hole. Environmental Geology (6), Marine Geology (14), Sediments, Clastic (28).
- T9. **Processes of Supradetachment Basins.**
Julio Friedmann, University of Southern California; Robert P. Fillmore, University of Kansas, Lawrence. Stratigraphy (29), Structural Geology (30), Tectonics (31).
- T10. **Environmental Geology: The Voice of Warning.**
Geology and Public Policy Committee, Institute for Environmental Education. Monica Gowan, GeoLogic, Bellingham, Washington. Engineering Geology (5), Environmental Geology (6), Hydrogeology (13).
- T11. **Environmental Geology: The Voice of Reason.**
Geology and Public Policy Committee, Institute for Environmental Education. Monica Gowan, GeoLogic, Bellingham, Washington. Engineering Geology (5), Environmental Geology (6), Hydrogeology (13).
- T12. **Interpreting Stromatolites: Biological vs. Sedimentological Information.**
John P. Grotzinger, Massachusetts Institute of Technology; Andrew H. Knoll, Harvard University. Paleontology/Paleobotany (18), Precambrian Geology (24), Sediments, Carbonates (27).
- T13. **Mineral Resources in Developing Nations: Economic Impact and Environmental Concerns.**
Institute for Environmental Education. Carroll Ann Hodges, U.S. Geological Survey, Menlo Park; Half Zantop, Dartmouth College. Economic Geology (4), Engineering Geology (5), Environmental Geology (6).
- T14. **Evolution and Global Consequences of the Himalayan Orogenic System.**
International Division. Kip V. Hodges, Massachusetts Institute of Technology. Geochemistry, Other (8), Paleontology/Paleobotany (18), Tectonics (31).
- T15. **Evolution and Biogeography of Marine Microplankton During the Paleocene Epoch.**
Brian T. Huber, Smithsonian Institution; Richard K. Olsson, Rutgers University. Micropaleontology (15), Paleoceanography/Paleoclimatology (17), Stratigraphy (29).
- T16. **Health Implications of Metals in Soils.**
Engineering Geology Division, Institute for Environmental Education. Holly L.O. Huyck, Denver, Colorado; Charles W. Welby, North Carolina State University. Engineering Geology (5), Environmental Geology (6), Geochemistry, Other (8).
- T17. **Constraints on the Evolution of the Early Earth.**
Stein B. Jacobsen and Charles L. Harper, Harvard University. Geochemistry, Other (8), Petrology, Igneous (21), Petrology, Metamorphic (22).
- T18. **Paleogeography of Silurian Taconica.**
Markes E. Johnson, Williams College, Williamstown, Massachusetts; David Roy, Boston College. Paleontology/Paleobotany (18), Sediments, Clastic (28), Stratigraphy (29).

- T19. **The Cretaceous-Tertiary Boundary Event: Biotic and Environmental Changes.**
Gerta Keller and Norman MacLeod, Princeton University. Paleocyanography/Paleoclimatology (17), Paleontology/Paleobotany (18), Stratigraphy (29).
- T20. **The New England–Acadian Shoreline Revisited.**
Joseph T. Kelley, University of Maine. Environmental Geology (6), Marine Geology (14), Quaternary Geology/Geomorphology (25).
- T21. **Deep Seismic Imaging across Continental Margins: From the Ocean–Continent Boundary to the Beach and Beyond. POSTERS ONLY**
Geophysics Division. Simon L. Klemperer, Stanford University; W. Steven Holbrook, Woods Hole Oceanographic Institution, Massachusetts. Geophysics/Tectonophysics (10), Structural Geology (30).
- T22. **Fate and Transport of Contaminants in Boston Harbor and Massachusetts Bay.**
Sedimentary Geology Division, SEPM (Society for Sedimentary Geology). Harley J. Knebel and Michael H. Bothner, U.S. Geological Survey, Woods Hole. Environmental Geology (6), Marine Geology (14), Sediments, Clastic (28).
- T23. **Advances in Tectonic Models of Precambrian Orogens from Structural Geology and Geochronology.**
Timothy M. Kusky, Boston University; Samuel A. Bowring, Massachusetts Institute of Technology. Geochemistry, Other (8), Precambrian Geology (24), Structural Geology (30).



■ Turbidites in Kittery Formation (Silurian?) cut by mafic dikes. Bald Head Cliff, southern Maine. Photo by Richard H. Bailey.

- T24. **The Geology of Natural Gas Resources: Challenges and Opportunities.**
Stephen E. Laubach, University of Texas at Austin. Economic Geology (4), Petroleum Geology (19), Sediments, Clastic (28).
- T25. **Structure and Geophysics of the Appalachian Orogen.**
Geophysics Division. James Luetgert, U.S. Geological Survey, Menlo Park; David B. Stewart, U.S. Geological Survey, Reston. Geophysics/Tectonophysics (10), Structural Geology (30), Tectonics (31).
- T26. **High-Resolution Paleozoic Isochrons.**
Paul C. Lyons, U.S. Geological Survey, Reston; Warren D. Huff, University of Cincinnati. Geochemistry, Other (8), Sediments, Clastic (28), Stratigraphy (29).
- T27. **Paleoenvironments in Oxygen-Deficient Basins: The Carbon-Sulfur-Iron System and Related Geochemical and Ecological Constraints.**
Society of Economic Geologists. Timothy W. Lyons, University of Michigan; Carlton E. Brett, University of Rochester. Economic Geology (4), Geochemistry, Other (8), Sediments, Clastic (28).
- T28. **First Transition Series Metals and Health: Fact and Fiction.**
George R. McCormick, University of Iowa. Economic Geology (4), Environmental Geology (6), Geochemistry, Other (8).

- T29. **Applications of Modern Geodetic Techniques to the Solution of Geological Problems.**
National Research Council, Committee on Geodesy. Jean-Bernard Minster, Scripps Institution of Oceanography; B. Clark Burchfiel, Massachusetts Institute of Technology. Geophysics, Tectonophysics (10), Remote Sensing (26), Tectonics (31).
- T30. **Isotope Paleobiology.**
Richard D. Norris, Woods Hole Oceanographic Institution; Richard M. Corfield, Oxford University, United Kingdom. Geochemistry, Aqueous/Organic (7), Geochemistry, Other (8), Paleontology/Paleobotany (18).
- T31. **New Perspectives on the Evolution of Atlantic Continental Rises.**
Dennis O'Leary, U.S. Geological Survey, Denver; C. Wylie Poag, U.S. Geological Survey, Woods Hole. Marine Geology (14), Paleocyanography/Paleoclimatology (17), Stratigraphy (29).
- T32. **Geochemistry and Chronology of Appalachian Mylonites and Shear Zones.**
Nicholas Rast, University of Kentucky; Alexander E. Gates, Rutgers University. Geochemistry, Other (8), Structural Geology (30), Tectonics (31).
- T33. **Environmental Issues in Urban Settings.**
 *Quaternary Geology and Geomorphology Division, Institute for Environmental Education.* John C. Ridge, Tufts University. Engineering Geology (5), Environmental Geology (6), Quaternary Geology/Geomorphology (25).
- T34. **Metamorphism, Fluid Flow, and Ore Deposits.**
Society of Economic Geologists. Douglas Rumble, Geophysical Laboratory, Washington, D.C.; Half Zantop, Dartmouth College. Economic Geology (4), Geochemistry, Aqueous/Organic (7), Petrology, Metamorphic (22).
- T35. **Flow and Transport in Variable-Density Ground Water. POSTERS ONLY**
Hydrogeology Division. Ward E. Sanford, U.S. Geological Survey, Reston; Shirley J. Dreiss, University of California, Santa Cruz. Environmental Geology (6), Geochemistry, Aqueous/Organic (7), Hydrogeology (13).
- T36. **Geologic Disposal of Nuclear Waste and the Risks to Public Health and Safety.**
 *Institute for Environmental Education.* Malcolm D. Siegel, Sandia National Laboratories. Engineering Geology (5), Environmental Geology (6), Geochemistry, Aqueous/Organic (7).
- T37. **Advances in Dating Young Ground Water.**
Hydrogeology Division. D. Kip Solomon, Oak Ridge National Laboratory; L. Niel Plummer, U.S. Geological Survey, Reston. Environmental Geology (6), Geochemistry, Aqueous/Organic (7), Hydrogeology (13).
- T38. **Thermobarometric Studies and P-T Path Determinations in Mountain Belts.**
Frank S. Spear, Rensselaer Polytechnic Institute; Robert J. Tracy, Virginia Polytechnic Institute and State University. Geochemistry, Other (8), Petrology, Metamorphic (22), Tectonics (31).
- T39. **Paleoecology of Pre-Carboniferous Terrestrial Ecosystems.**
Paul K. Strother, Weston Observatory, Boston College; William Shear, Hampden-Sidney College, Virginia. Paleontology/Paleobotany (18), Sediments, Carbonates (27), Stratigraphy (29).
- T40. **Pluton Interiors: Structure and Dynamics.**
Othmar T. Tobisch, University of California, Santa Cruz; Alexander R. Cruden and Patrick Launeau, University of Toronto. Geophysics/Tectonophysics (10), Petrology, Igneous (21), Structural Geology (30).
- T41. **New Developments in Quaternary Geology: Implications for Geoscience Education and Research.**
 *National Association of Geology Teachers, Quaternary Geology and Geomorphology Division.* Brian B. Tormey, Pennsylvania State University. Environmental Geology (6), Geology Education (9), Quaternary Geology/Geomorphology (25).
- T42. **Hydrogeology of Fractured Glacial Sediments and Fractured Crystalline Rock.**
Hydrogeology Division. Garth van der Kamp, National Hydrology Research Centre, Saskatoon, Saskatchewan; Allen M. Shapiro, U.S. Geological Survey, Reston. Hydrogeology (13), Geochemistry, Aqueous/Organic (7), Geophysics/Tectonophysics (10).

For further description of theme sessions, see the April issue of *GSA Today*, call the advocate directly, or contact the GSA Meetings Department.

Environmental, Health, and Hydrogeology Highlights

TECHNICAL PROGRAM

- A Crisis in Waste Management, Economic Vitality, and a Coastal Marine Environment: Boston Harbor and Massachusetts Bay
- Keynote Symposium—Geology and Health
- Geological Insight and Ground-Water Modeling
- Fluids and Fluid Flow in the Crust
- Geochemical Aspects of Minerals in Physiological Fluids
- Human Problems, Foraminiferal Solutions
- Geochemistry of Large Rivers
- Geologic Impacts of the Gulf War
- Hydrogeochemistry Related to Health and Disease
- The Urban Ocean Environment: Geological Perspectives
- Environmental Geology: The Voice of Warning
- Environmental Geology: The Voice of Reason
- Mineral Resources in Developing Nations: Economic Impact and Environmental Concerns
- Health Implications of Metals in Soils
- The New England—Acadian Shoreline Revisited
- Fate and Transport of Contaminants in Boston Harbor and Massachusetts Bay
- The Geology of Natural Gas Resources: Challenges and Opportunities
- First Transition Series Metals and Health: Fact and Fiction

- Environmental Issues in Urban Settings
- Flow and Transport in Variable-Density Ground Water
- Geologic Disposal of Nuclear Waste and the Risks to Public Health and Safety
- Advances in Dating Young Ground Water
- Hydrogeology of Fractured Glacial Sediments and Fractured Crystalline Rock

CONTINUING EDUCATION

- Introducing ... Contaminant Hydrogeology: A Workshop
- Urban Geology: Foundation for Inner City Health
- Contaminant Hydrogeology: Practical Monitoring, Protection, and Cleanup
- Application of Sedimentological Information to Hydrogeological Problems
- Environmental/Engineering Geology and Land-Use Planning—An Interface Between Science and Regulations
- Isotope Hydrology

FIELD TRIPS

- Methods of Characterizing Fluid Movement and Chemical Transport in Fractured Rock
- Coastal Geologic Hazards and Management Strategies along a Complex Microtidal Coastline
- Ground-Water Contamination and Solute-Transport Research at the U.S. Geological Survey's Cape Cod Field Site



FIELD TRIPS

Boston will serve as the hub for a variety of exciting field trips throughout New England and the Northeast during the spectacular fall foliage season! Come join one or more of these exciting excursions and see how our interpretation of these rocks has changed since the last time GSA met in Boston, more than 40 years ago.

All trips will begin and end in Boston unless otherwise indicated. Participants must provide their own transportation to the starting point. **With substantially lower airfares on Saturday night stayover flights, you can pay for a premeeting or postmeeting field trip with the savings!**

Most trips are technical in nature, and some can be physically rigorous. Please check with the leader if you have any questions or have special needs.

Trip fees include transportation during the trip. Guidebook is included unless otherwise noted. Other services such as meals and lodging are noted by the following symbols: B—breakfast, L—lunch, D—dinner, and ON—overnight lodging.

Preregistration for a field trip is recommended because of participation limitations. **PREREGISTRATION DEADLINE: Must be RECEIVED at GSA headquarters no later than September 24.** Registration after the deadline may be possible if trip logistics and space permit by contacting the GSA Field Trip Coordinator. A field trip *only* registration fee of \$25 is required if you are not attending the meeting. This fee may be applied to a meeting registration if you decide to attend.

CANCELLATION DEADLINE IS OCTOBER 1. No refunds will be given after this date. If GSA must cancel a field trip because of logistics or registration requirements, a full refund will be issued to you after the meeting. **For pre- and postmeeting trips, also be aware of cancellation penalties imposed by the airlines. Plan alternatives in advance should the trips you are registered for cancel.**

GUIDEBOOKS may be purchased during the meeting at the Field Trip Desk. See future issues of *GSA Today* for information on postmeeting purchases.

Premeeting

1. Layered Gabbro-Diorite Intrusions of Coastal Maine: Basaltic-Infusions into Silicic Magma Chambers.

Thursday, October 21 through Sunday, October 24. R. A. Wiebe, Dept. of Geosciences, Franklin & Marshall College, Lancaster, PA 17604, (717) 291-3820; and Marshall Chapman, University of Massachusetts, Amherst. Limit: 44. Fee: \$290 (3 B, 3 L, 3 D, 3 ON).

This trip will visit superb coastal exposures of three different Silurian-Devonian intrusions that contain complexly interlayered mafic and silicic rocks. These intrusions (Pleasant Bay, Mount Desert Island, and Isle au Haut) were emplaced at shallow crustal levels and probably fed volcanic

systems. Gabbroic layers, their bases chilled against silicic cumulates, record the plutonic expression of mafic infusions into floored silicic magma chambers. Comparable basaltic injections are thought to occur in silicic chambers beneath long-lasting silicic volcanic systems (e.g., Yellowstone, Crater Lake). Silicic pipes and load-cast structures developed along the bases of many chilled gabbroic layers in response to gravitational instabilities caused by the ponding of basaltic magma on incompletely solidified cumulate silicic mush. Macrorhythmic layers that grade upward from basally chilled gabbro to highly silicic cumulates record hybridization between ponded basaltic magma and overlying silicic magma along a double-diffusive boundary. We will also examine the Cadillac Mountain granite—the solidified silicic magma chamber into which the layered gabbrodiorites of Mount Desert Island were emplaced.

2. Sequence and Correlation of Tectonic and Metamorphic Events in Southeastern Vermont.

Thursday, October 21 through Sunday, October 24. James B. Thompson, Jr., Dept. of Earth Sciences, Dartmouth College, Hanover, NH 03755, (603) 646-2373 and Harvard University; John L. Rosenfield, University of California; and C. Page Chamberlain, Dartmouth College. Limit: 43. Fee: \$365 (3 B, 3 L, 3 D, 3 ON).

This trip will examine the “marble-cake” geology associated with the Chester and Athens domes of southeastern Vermont. The structural and metamorphic features of this area are strongly reminiscent of those found in the lower Pennine nappes of the western Alps, but can be seen here amid the gentler, bucolic surroundings of rural New England. We shall “peel the onion” of this complex terrane by approaching the domes from the outside in. By successively examining and taking into account the effects of the later processes, we can gain deeper understanding of the earlier ones. The trip will present a distillation of more than 40 years of field and laboratory investigations. We shall see exceptionally fine examples of metamorphic mineral assemblages in pelitic, calc-silicate, mafic, and ultramafic rocks, and other more specialized lithic types. A special feature will be the chronologic interpretation, aided by unstable isotope studies and zoning profiles, of rotated porphyroblasts, and the relationship of these to other structural features at both outcrop and map scale. Stable isotope studies have given us an increasingly clear picture of the migration of fluid species during the several tectono-metamorphic events.

3. A Tectonic-Stratigraphic Transect Across the New England Caledonides of Massachusetts.

Thursday, October 21 through Sunday, October 24. Cosponsored by New England Intercollegiate Geological Conference (NEIGC). Nicholas Ratcliffe, U.S. Geological Survey, Reston, VA 22092, (703) 648-6901; Peter Robinson, U.S. Geological Survey, Reston; and Chris Hepburn, Boston College, Chestnut Hill. Limit: 43. Fee: \$400 (3 B, 3 L, 3 D, 3 ON, bedrock map of Massachusetts).

This trip provides a comprehensive and current overview, over a distance comparable to a transect across the Swiss Alps, of this narrow part

of the northern Appalachians from Laurentia across the vestiges of two former oceans to the Boston Avalon zone. It will use cross sections and geology shown on the 1983 *Bedrock Geologic Map of Massachusetts* to discuss current ideas about the tectonic evolution of this multi-orogenic, polymetamorphic mountain belt. Attention will be given to paleontology, stratigraphy, geochronology, structure, and igneous and metamorphic petrology. Day 1 will cover the deformed Cambrian-Ordovician carbonate bank of the Laurentian margin, the Taconic thrust sheets, thrust slices of Grenvillian rocks of the Berkshires, vestiges of Iapetus and the Taconian accretionary prism, the Silurian-Devonian Connecticut Valley belt, and the Acadian overprint on the Taconide belt. Day 2 will cover Proterozoic and Ordovician rocks of the Bronson Hill magmatic arc, Silurian-Devonian stratigraphy including the Bernardston fossil locality, Acadian fold and thrust nappes, Acadian and Pennsylvanian gneiss domes, Acadian granulite-facies metamorphism of Silurian strata in the Merrimack belt, and questions about Acadian plate motion. Day 3 will cover the Worcester low-grade zone, the Nashoba zone, the eastern New England fault systems, and the Boston Avalon zone with its Proterozoic volcanic and intrusive basement, late Proterozoic Boston cover, Ordovician alkalic intrusions, Late Silurian-Early Devonian arc volcanics, and Pennsylvanian continental basins.

4. Petrologic and Isotopic Studies in Metamorphic Rocks of Eastern Vermont and Western New Hampshire.

Thursday, October 21 through Sunday, October 24. Douglas Rumble, Geophysical Laboratory, 5251 Broad Branch Road, Washington, DC 20015-1305, (202) 686-2483; J. M. Ferry, Johns Hopkins University; C. P. Chamberlain, Dartmouth College; and F. Spear, Rensselaer Polytechnic Institute, Troy, New York. Limit: 30. Fee: \$320 (3 B, 3 L, 2 D, 3 ON).

The two themes of this field trip are (1) metamorphic petrology and tectonics and (2) petrology and fluid flow. Participants will visit outcrops and examine petrologic evidence of tectonic events. We will study outcrops of the Fall Mountain nappe and discuss the petrologic record of crustal thickening that accompanied emplacement of the nappe. Participants will also visit outcrops and examine petrologic evidence of fluid flow during metamorphism. We will investigate the outcrop record of regional-scale fluid flow in eastern Vermont. New stable isotope data, especially the discovery of $\delta^{18}\text{O}$ zonation in garnets from the area, will be presented. Among the features to be seen are fluid buffering at Black Mountain, New Hampshire, the Beaver Brook fossil locality, and the type locality of Wonesite and associated multi-amphibole assemblages.

5. Granite Pegmatites in Northern New England.

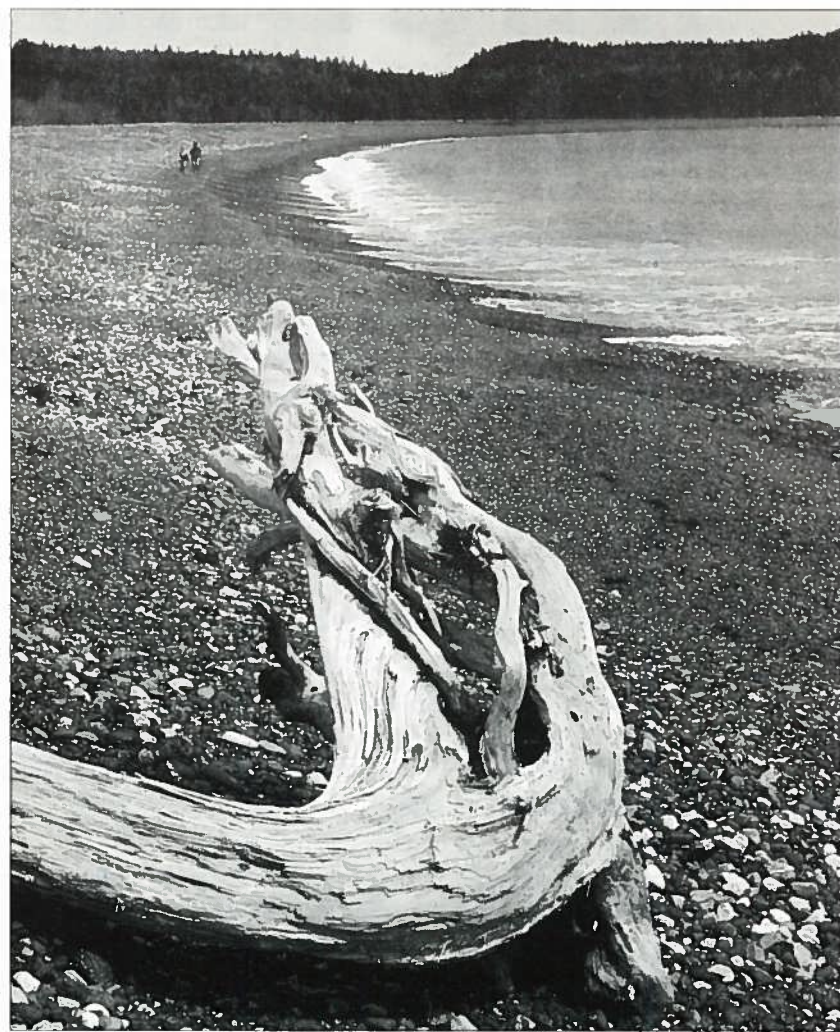
Friday, October 22 through Sunday, October 24. Carl A. Francis, Mineralogical Museum, Harvard University, 24 Oxford St., Cambridge, MA 02138, (617) 495-4758; William Metropolis, Harvard University; Michael Wise, Smithsonian Institution; and Anthony Kampf, Los Angeles County Museum of Natural History. Limit: 42. Fee: \$300 (2 B, 2 L, 1 D, 2 ON).

Rare-earth-element pegmatites in New England have been mined for mica, feldspar, and various other mineral commodities for nearly 200 years. Superior exposure at the few currently active mines make them excellent places to observe the mineralogy and internal structure of granitic pegmatites. Stops will include the Palermo No. 1 beryl-phosphate-type pegmatite in North Groton, New Hampshire, arfvedsonite-bearing miarolitic pegmatites on Hurricane Mountain, Intervale, New Hampshire; lithium silicate-bearing pegmatites on Black Mountain in Rumford, Maine; the Bennett mine in Buckfield, Maine; and Pulsifer pegmatite on Mt. Apatite in Auburn, Maine. The latter are noted for their gem tourmaline and for other crystallized minerals. Pegmatite paragenesis will be discussed in light of mineralogical, textural, structural, and geochemical evidence. Genetic relations to nearby plutons will also be considered.

6. A Transect through the Taconide Zone of Central Vermont.

Thursday, October 21 through Sunday, October 24. Rolfe Stanley, Dept. of Geology, University of Vermont, Burlington, VT 05405-0122, (802) 656-3396; Delbert Martin, University of Vermont; Raymond Coish, Middlebury College, Vermont; and Jo Laird, University of New Hampshire. Limit: 42. Fee: \$335 (3 B, 3 L, 2 D, 3 ON).

Central Vermont provides an excellent field laboratory for studying the tectonic transition between the foreland and the hinterland of the Taconide Zone of Middle Ordovician age in northwestern New England because many of the major lithotectonic units are exposed across a 40-km-wide belt. This trip will begin in the Champlain thrust zone of the foreland and end along the unconformity between the Silurian-Devonian sequence and the Middle Ordovician rocks of the Taconian fore-arc basin. During the trip we will study the foreland-hinterland transition along the Hinesburg thrust, examine the basement-cover relations of the Lincoln massif, and compare the sedimentary origin and tectonic history between the older accretionary wedge and the younger but less deformed rocks of the fore-arc basin of the Taconide zone. Where possible, the discussion will focus on the integrated history based on sedimentary, structural, geochemical, petrologic, and radiometric evidence.



■ Jasper Beach, Machiasport, Maine. The beach derives its red cobbles from erosion of Devonian rhyolite. Beach cusps are particularly well developed. Photo by Joseph T. Kelley.

7. Sea-level Change, Coastal Processes, and Shoreline Development in Northern New England.

Friday, October 22 through Sunday, October 24. Joseph T. Kelley, Dept. of Geological Sciences, University of Maine, Orono, ME 04469, (207) 581-2162; Daniel Belknap, University of Maine, Orono; and Duncan FitzGerald, Boston University. Limit: 43. Fee: \$260 (2 B, 3 L, 2 D, 2 ON).

Late Quaternary sea level has ranged more than 50 m above and below its present elevation along the northern New England coast. On this trip, we will examine raised shorelines and emergent marine sediment, as well as salt-marsh systems used to construct recent sea-level-change curves. Recent work on the inner continental shelf will be presented. The geomorphologic response of undeveloped, as well as intensely developed, river-associated and pocket beaches to recent storms and rising sea level will be examined. Drumlins, till deposits, and rivers along the coast from Boston to southern Maine will be evaluated as sources of recent beach sediment. This trip will afford an opportunity to see a variety of classic glacial deposits, sea-level indicators, beaches, marshes, and other coastal settings from the totally developed coast near Boston to the wilderness of Maine.

8. Alleghanian Assembly of Proterozoic and Paleozoic Lithotectonic Terranes in South-Central New England: New Insights from Geochronology and Petrology.

Thursday, October 21 through Sunday, October 24. Robert P. Wintsch, Dept. of Geological Sciences, Indiana University, Bloomington, IN 47405, (812) 855-4018; John Sutter and M. J. Kunk, U.S. Geological Survey, Reston; and J. N. Aleinikoff, U.S. Geological Survey, Denver. Limit: 42. Fee: \$280 (2 B, 3 L, 3 D, 3 ON). NOTE: Some stops will require a hard hat and reflective vest. Participants are asked to supply their own equipment.

New geochronologic and field data are revealing that the five eastern-most lithotectonic terranes in southeastern New England were assembled into a stack of thrust nappes during the Alleghanian (Permian) orogeny. These data show that the assembling of these terranes postdates peak Acadian (Devonian) and older metamorphism in all terranes including the Avalon, where peak metamorphism is Alleghanian. On this trip we will examine amphibolite to lower granulite facies rocks from the Avalon, Putnam-Nashoba, Merrimack, Central Maine, and Bronson Hill terranes, in the context of these new data. Specifically, we will examine some spectacular exposures of orthogneiss, paragneiss, schist, and S- and L-tectonites. We will inspect mylonitic and blastomylonitic rocks, some with multiple generations of fabrics and folding, from ductile fault zones along several terrane boundaries. We will observe differences in mineralogy, structure, metasomatism, and fabrics of fault rocks as a function of time of deformation: either pre- or post-peak metamorphic. We will use mineral apparent ages in the $^{40}\text{Ar}/^{39}\text{Ar}$ and U/Pb systems and metamorphic petrologic data, many of them gathered from the field trip stops, to document Carboniferous and Permian ages of cooling, deformation, and exhumation.

9. The Late Glacial Marine Invasion of Coastal Central New England (Northeastern Massachusetts–Southwestern Maine):

Its Ups and Downs.

Friday, October 22 through Sunday, October 24. Thomas K. Weddle, Maine Geological Survey, State House Station 22, Augusta, ME 04333, (207) 287-2801; Carl Koteff, U.S. Geological Survey, Reston; Woodrow Thompson and Cheryl Marvinney, Maine Geological Survey; and Michael Retelle, Bates College, Lewiston, Maine. Limit: 41. Fee: \$240 (2 B, 2 L, 2 D, 2 ON).

Retreat of the late Wisconsinan Laurentide ice sheet from the Boston area into southwestern Maine between 15,000 and 13,500 yr B.P. was accompanied by invasion of the late-glacial sea. Precisely obtained present-day altitudes of ice-marginal deltas deposited during systematic ice retreat provide a record of sea-level fluctuations during this time and characterize the nature of postglacial uplift in the region. Detailed mapping of deglacial-phase deposits in the field trip area has provided excellent examples of deltas, fans, stratified end moraines, and fossiliferous glacial marine mud, as well as nearshore deposits associated with postglacial uplift. In addition, this trip will show how delta topset-foreset contact altitudes suggest that postglacial uplift was delayed until the retreat margin was well into Maine and New Hampshire, and that eustatic sea level appears to have been relatively unchanged from the uncovering of the Boston area until 14,000 yr B.P., when the ice margin was in southwestern Maine and adjacent New Hampshire. Then, within 50 to 100 yr, sea level appears to have risen sharply, 7–10 m, before leveling off. This information supports offshore studies that suggest little appreciable melt water was added to the ocean system until after 14,000 yr B.P. The trip will be based in Freeport, Maine, a tourist shopping mecca and home of L.L. Bean, Inc., open 24 hours a day, 365 days a year. Saturday night dinner is a New England clambake (choice of lobster or steak).

10. Geochronology and Petrogenesis of Adirondack Igneous and Metamorphic Rocks.

Thursday, October 21 through Sunday, October 24. James M. McLelland, Dept. of Geology, Colgate University, 13 Oak Drive, Hamilton, NY 13346-1398, (315) 824-7202. Limit: 45. Fee: \$290 (3 B, 4 L, 3 D, 3 ON).

On this trip we will examine the principal lithologies of the Adirondack Highlands (granulite facies) and will focus on localities that have been dated by U-Pb and Sm-Nd methods and which bear critically on the origin and evolution of the rocks involved. Igneous types will include a range of anorthositic rocks and related Fe-Ti ores together with their mangeritic, charnockitic, and granitic envelopes (AMCG suite—emplaced at 1130–1150 Ma). We will also see older (ca. 1300 Ma) tonalitic-granodioritic and younger (ca. 1060 Ma) leucogranites. Metasedimentary rocks will include a variety of garnet-sillimanite metapelites, wollastonite skarns, monticellite-akermanite skarns, etc., and their related structure. We will examine olivine metagabbro (coronites) and the giant garnet deposits at Gore Mountain. The trip will concentrate on the High Peaks area but will move south through the central Adirondacks.

11. Carboniferous Geology of the Anthracite Fields of Eastern Pennsylvania and New England.

Thursday, October 21 through Sunday, October 24. Sponsored by GSA Coal Geology Division. Jane Eggleston, U.S. Geological Survey, 956 National Center, Reston, VA 22092, (703) 648-6464; William E. Edmunds, consulting geologist, Harrisburg, Pennsylvania; Daniel P. Murray, University of Rhode Island; Jeffrey R. Levine, consulting geologist, Tuscaloosa, Alabama; and Paul C. Lyons, Christopher Wnuk, and Vicki Weintraub, U.S. Geological Survey, Reston. Limit: 22. Fee: \$285 (3 B, 3 L, 2 D, 3 ON). Trip begins in Harrisburg, Pennsylvania.

This trip will emphasize the sedimentology, tectonic history, paleobotany, and coal-mining geology of the Middle and Late Pennsylvanian Lewellyn Formation (eastern Pennsylvania) and Early to Middle Pennsylvanian Pondville Conglomerate and Rhode Island Formation (New England). An additional theme in eastern Pennsylvania will be the regional stratigraphic and depositional relations of the middle to Late Mississippian Mauch Chunk Formation and the Early to Middle Pennsylvanian Pottsville Formation. The first two days will include an examination of the type section of the basal Pennsylvanian Pottsville Formation, visits to the deep mine and an active open-pit coal mine, investigation of a beautifully exposed “whaleback” anticline and underclay flora in an abandoned strip mine, and stops at several road cuts and a quarry, all in eastern Pennsylvania. The third day will include travel to and stops within the Narragansett and Norfolk basins of New England, where we will examine the coal beds, plant fossils, and structure and review the tectonic setting and mining history of the coal-bearing Rhode Island Formation. Finally, we will view the spectacular basal Pennsylvanian boulder conglomerate.

12. Geology of the Coastal Lithotectonic Belt, Southwestern Maine and Southeastern New Hampshire.

Friday, October 22 through Sunday, October 24. Cosponsored by New England Intercollegiate Geological Conference (NEIGC). Arthur M. Hussey II, Dept. of Geology, Bowdoin College, Brunswick, ME 04011, (207) 725-3219; and Wallace Bothner, University of New Hampshire. Limit: 44. Fee: \$195 (2 B, 2 L, 2 D, 2 ON).

Join us for a trip along the scenic coast of southwestern Maine and southeastern New Hampshire between Portland, Maine, and Newburyport, Massachusetts. We will examine the well-exposed coastal outcrops of lower Paleozoic and older (?) polydeformed and polymetamorphosed metasedimentary and metavolcanic rocks of the Coastal Lithotectonic Belt. We will also examine some of the intrusive igneous rocks ranging in age from Ordovician to Cretaceous. Discussions at stops will focus on (1) the accretionary history of terranes comprising the Coastal Lithotectonic Belt, (2) the relation of these terranes to the Avalonian terrane to the east and the Central Maine terrane to the west, and (3) methods and problems in determining the ages and episodes of deformation of this belt, ranging from Penobscottian to Alleghanian.

13. Petrology and Field Relations of Successive Metamorphic Events in Pelites of West-Central Maine.

Friday, October 22 through Sunday, October 24. Charles V. Guidotti, Dept. of Geological Sciences, University of Maine, Orono, ME 04469, (207) 581-2153; and M. J. Holdaway, Southern Methodist University, Dallas. Limit: 44. Fee: \$210 (2 B, 2 L, 2 D, 2 ON).

On this trip we will examine pelitic metamorphic rocks of at least three events, M2, M3 (Devonian), and late Carboniferous age metamorphism in west-central Maine. Special attention will be paid to (1) cause and effect relations between metamorphism and plutonism; (2) textural relations that help to determine metamorphic sequence; (3) relations among mineral assemblage, composition, and grade; and (4) relations among pressure, temperature, time, and spatial distribution of metamorphic events. Opportunities for specimen collecting will be numerous.



■ Large recumbent fold in Silurian-Devonian metasedimentary rocks near summit of Mt. Monadnock, New Hampshire. Photo by J. Christopher Hepburn.

14. Migmatites of Southern New England: Melting, Metamorphism, and Tectonics.

Thursday, October 21 through Sunday, October 24. Eileen McLellan, Dept. of Geology, University of Maryland, College Park, MD 20742, (301) 405-4365; and Bob Tracy, Virginia Polytechnic Institute. Limit: 44. Cost: \$360 (3 B, 3 L, 3 D, 3 ON).

This trip will focus on possible interactions among tectonic setting, heat transfer, melting, and metamorphism as exemplified by the migmatites of southern New England. A wide variety of migmatite types is exposed here, in both metasedimentary and metaigneous rocks, representing melting under a range of pressure-temperature regimes. We will begin by examining incipient melting in high-pressure rocks of western Connecticut, followed on the second day by a visit to the classic migmatite localities of southern Massachusetts. There we will have the opportunity to discuss the relations among migmatites, metamorphic grade, and nappe emplacement. On the third day we will move to the coast of Connecticut to look at migmatites associated with granite plutons, and we will examine the problems of determining the spatial, temporal, and geochemical relations between local melting and larger scale plutonism. We will also discuss structural controls on melt segregation and the role of regional rapid uplift in dehydration melting. This trip offers a unique opportunity to examine a wide range of migmatites in varied tectonic settings within a relatively small region.



15. Ring Dikes and Plutons: The Deeper View of Calderas.

Thursday, October 21 through Sunday, October 24. John W. Creasy, Dept. of Geology, Bates College, Lewiston, ME 04240, (207) 786-6153; and Nelson Eby, University of Massachusetts, Lowell. Limit: 44. Fee: \$310 (3 B, 3 L, 3 D, 3 ON).

Mesozoic and younger magmatic centers (the White Mountain magma series) of northern New England document the geologic and petrologic evolution of a variety of magma types intruded at shallow crustal levels. Two examples will be examined on this field trip: (1) The White Mountain batholith (1000 km²) presents a slice of a Middle Jurassic caldera field cut about 1.5 km thick and 1–2 km below the original land surface. Two-km-thick sequences of intracaldera fill (rhyolitic crystal tuff and breccia) are partially enclosed by composite ring dikes; a mosaic of small granitic plutons overlaps caldera formation in space and time. (2) In contrast, the Cretaceous Mount Pawtuckaway complex (<10 km²) exposes cumulus pyroxenite, gabbro, diorite, and monzonite representing emplacement of multiple mafic magmas as ring dikes and plugs. The petrologic evolution of both examples will be discussed on the basis of comprehensive geochemical and geochronological studies in the context of field relations illustrated by this trip. Discussion of the relation of contemporaneous mantle magmatism and voluminous silicic crustal melts will provide an overview of the rifted margin of New England.

16. High-Pressure Taconian and Subsequent Polymetamorphism of Southern Quebec and Northern Vermont.

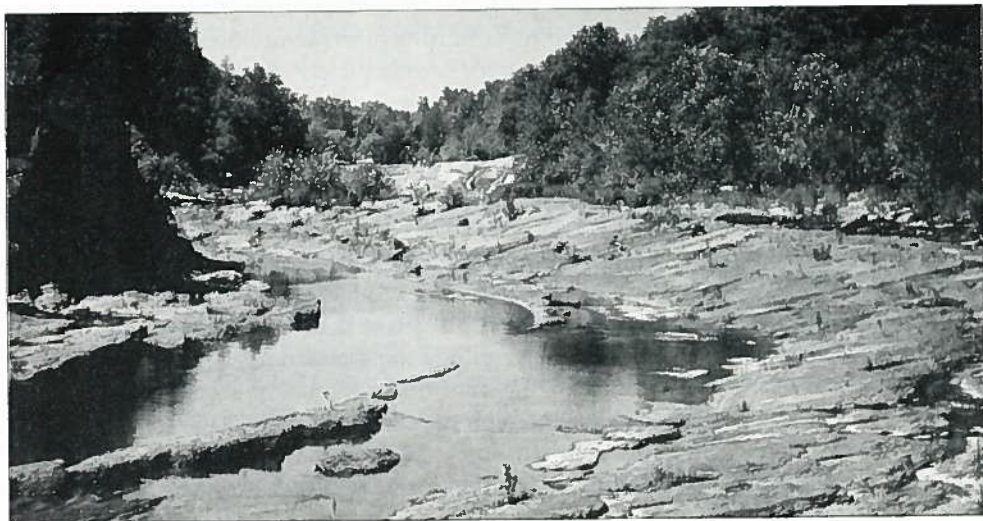
Friday, October 22 through Sunday, October 24. Jo Laird, Dept. of Geology, University of New Hampshire, Durham, NH 03824-3589, (603) 862-1718; and Walter Trzcinski, Jr., Université de Montréal, Canada. Limit: 44. Fee: \$345 (2 B, 3 L, 2 D, 2 ON). Note: Because this trip goes into Canada, each participant must show adequate proof of citizenship prior to departure. A birth certificate or passport is acceptable.

Remnants of high-pressure Taconian metamorphism are found in a structural envelope from Richmond, Quebec, southward to Rochester, Vermont. At the north end of this envelope, Na-Ca amphiboles are present in metamorphosed volcanic and volcanoclastic rocks of the Tibbitt Hill Formation (Cambrian), and high-Al pumpellyite is characteristic of calc-silicate assemblages found within the ultramafic rocks of the Asbestos "ophiolite." Pressure estimates for the recrystallization of these rocks are in the neighborhood of 7 kbar at 350 to 450 °C. In northern Vermont, Na-Ca amphiboles are present in Cambrian to Ordovician rift and slope-rise volcanic and volcanoclastic rocks. The highest pressure assemblages occur in the Belvidere Mountain–Tillotson Peak–Haystack Mountain area, where glaucophane is found in mafic and pelitic schists, and the assemblage omphacite + garnet occurs in mafic schist. Mineral growth during two stages of deformation record (1) increasing *T* and *P* from 380 °C and 9.5 kbar to 550 °C and 12.5 kbar during F1 folding in a down-going slab, followed by (2) decreasing *T* to 480 °C about 7–10 kbar during F2 folding and emplacement of shear packets. We will begin in the Oak Hill sequence, which contains the Tibbit Hill volcanics, and will continue eastward across the Iapetan margin to look at continental slope-ocean basin-derived rocks of the Quebec Appalachians. Continuing southward into Vermont, we will examine the Belvidere Mountain–Tillotson Peak–Haystack Mountain area. A traverse on foot (1400 feet of relief) is planned in order to see the blueschist and eclogite and their contact with metasedimentary rocks of the "hinterland." This contact is decorated by slices of ultramafic rock and is interpreted as a fault. Farther south we will examine the overprint of Acadian metamorphism on Taconian assemblages in mafic and pelitic schists.

17. Paleoenvironmental Traverse Across the Early Mesozoic Hartford Rift Basin, Connecticut.

Friday, October 22 through Sunday, October 24. Sponsored by GSA Sedimentary Geology Division. Gregory S. Horne, Dept. of Earth Sciences, Wesleyan University, Middletown, CT 06459, (203) 347-9411, ext. 2834; and Nicholas McDonald, Peter LeTourneau, and Jelle de Boer, Wesleyan University. Limit: 42. Fee: \$255 (2 B, 2 L, 1 D, 2 ON).

On this trip we will focus on reconstructing the sedimentary and tectonic paleoenvironments as indicated in the stratigraphic succession



■ Nose of plunging syncline in Devonian Esopus Formation, Catskill Creek near Leeds, New York. Photo by Martin E. Ross.

within the Upper Triassic to Lower Jurassic Newark Supergroup exposed in the Hartford basin, one of the earliest studied rift basins in eastern North America. The trip will be an east-to-west traverse through the following interpreted environments: the eastern border fault of the basin, upper fan and mid-fan facies, lower fan and lake shore facies, alternating shallow and deep lacustrine facies, basalt flows and diabase sills, playa and western shoreline facies, alluvial plain facies, and the western margin of the basin, with the Great Unconformity. The guidebook will include a historical note on early studies in the basin and a thorough review of recent studies. An introductory program will be held on Friday evening, and an open house at Dinosaur State Park will be held on Saturday evening.

18. Field Evidence and Petrogenesis of the A-type and I-type Paleozoic Plutonic Complexes of Eastern Massachusetts.

Friday, October 22 through Sunday, October 24. Cosponsored by New England Intercollegiate Geological Conference (NEIGC). Rudolph Hon, Dept. of Geology and Geophysics, Boston College, Chestnut Hill, MA 02167, (617) 552-3656; Matt Paige, Indiana University, Bloomington; and Chris Loftenius, Engineering-Science, Inc., Pasadena, California. Limit: 43. Fee: \$300 (2 B, 2 L, 2 D, 2 ON).

We will visit the hypersolvus Cape Ann plutonic complex (A-type) on the first day and the calc-alkalic (I-type) Sharpners Pond plutonic suite on the second day. Evidence we will see on this trip suggests comparable petrogenetic processes for both magmatic suites even though they belong to two distinctly different magmatic lineages. Both suites follow a similar petrogenetic trend: a two-magma igneous system with magma mixing and fractional crystallization. The suites also contain anatectic melts of similar composition but which differ primarily in the nature of their mafic counterparts: alkali basalt in the Cape Ann and calc-alkali high-alumina basalt in the Sharpners Pond. We will have an opportunity to examine the geochemical data and discuss the evidence for petrogenesis.

19. Methods of Characterizing Fluid Movement and Chemical Transport in Fractured Rock.

Saturday, October 23 through Sunday, October 24. Allen M. Shapiro, U.S. Geological Survey, 431 National Center, Reston, VA 22092, (703) 648-5884; Paul Hsieh, U.S. Geological Survey, Menlo Park; and Carole Johnson, U.S. Geological Survey, Bow, New Hampshire. Limit: 43. Fee: \$195 (1 B, 2 L, 1 D, 1 ON).

On this trip we will visit the Hubbard Brook experimental forest in central New Hampshire. Nestled in the southern extent of the White Mountains and offering the possibility of spectacular fall foliage at the time of the outing, this location is the site of a USGS-led investigation into the application and development of field techniques and interpretive methods of characterizing fluid movement and chemical transport in fractured rock over length dimensions that range from meters to kilometers. Walking excursions will be provided to describe the local hydrology and geology. The trip will also exhibit equipment and field methods of characterizing fluid movement and chemical transport in fractured rock, including fracture mapping, surface and bore-hole geophysical techniques, and hydraulic and tracer testing.

20. Highlights of Proterozoic Geology of Boston.

Sunday, October 24. Cosponsored by New England Intercollegiate Geological Conference (NEIGC). Nicholas Rast, Dept. of Geological Sciences, University of Kentucky, Lexington, KY 40506-0059, (606) 257-6932; James Skehan, Boston College; and Steve Grimes, University of Texas, Austin. Limit: 43. Fee: \$65 (1 L).

This trip will show the structural and stratigraphic sequences and interpreted tectonic relations of some of the key Proterozoic formations in the Boston Avalon zone, mainly with regard to the Bloody Bluff fault zone. These Proterozoic rocks, which may have originated in northwest Africa, have become part of the Appalachian chain after the closing of the Iapetus Ocean and subsequent reopening of the Atlantic Ocean. Despite more than 100 years of intensive study, interpretation of the Boston Avalon rocks remains controversial. Evidence will be presented that major mylonitic zones were formed in Proterozoic time. Thus, field trip participants can expect lively discussions.

21. Archaeological Geology of Long Island, Boston Harbor.

Sunday, October 24. Cosponsored by GSA Archaeological Geology Division. Barbara E. Luedtke, Dept. of Anthropology, University of Massachusetts, 100 Morrissey Blvd., Boston, MA 02125, (617) 287-6850; and Peter Rosen, Northeastern University, Boston. Limit: 44. Fee: \$50 (1 L).

This trip will focus on two recently discovered sites on Long Island, the largest island in Boston Harbor. The oldest artifact found so far in the Boston area comes from one of these sites, but they were occupied primarily between 4000 and 500 yr B.P. Occupation alternated between these sites, possibly due to migration of a sand spit across the shore. The field trip will allow visitors to contribute to the discussion of this and other hypotheses for the alternation of these sites. In addition, Long Island displays a well-developed barrier beach, and drumlins are exposed in erosional scarps along the beach, the site of earlier erosion rate studies by Clifford Kaye.



■ View from Great Head across Sand Beach Cove, Mt. Desert Island, Maine, Acadia National Park. Glacially sculpted rock is Devonian granite. Photo by Richard H. Bailey.

22. Pleistocene Geology of the Boston Basin and Its Adjacent Surroundings.

Sunday, October 24. Cosponsored by *New England Intercollegiate Geological Conference (NEIGC)*. William A. Newman, Dept. of Geology, Northeastern University, Boston, MA 02115, (617) 437-4382; Richard Berg, Illinois State Geological Survey, Champaign; and David Mickelson, University of Wisconsin, Madison. Limit: 43. Fee: \$65 (1 L).

On this trip we will travel to the well-exposed Pleistocene drumlin sections of Long Island, located in the middle of Boston Harbor, and Fourth Cliff in Scituate, about 25 miles southeast of Boston. Participants will view evidence of a multiple-till stratigraphy and an erosion origin for the present drumlin morphology in eastern Massachusetts. Seismic sections connecting the onshore and offshore geology and stratigraphy will be presented and evaluated. Discussion will include the style of retreat of the Laurentide ice sheet and the complex late Wisconsinan and Holocene sea-level history in eastern Massachusetts.

23. Dimension-Stone Quarries: A New England Resource in Transition.

Sunday, October 24. Steven J. Stokowski, Stone Products Consultants, 10 Clark St., Ashland, MA 01731, (508) 881-6364; Jim Purdy, Geomapping Associates, Pittsford, Vermont; and Ed Myskowski, Salem, Massachusetts. Limit: 43. Fee: \$80 (1 L).

On this trip we will examine the geological, historical, and technological reasons for the rise and decline of New England's dimension-stone industry. The quarries provide unique, but perhaps biased, exposures that form the basis of much of the historical understanding of igneous rocks. We will visit such exposures in both active and inactive quarries. These quarries literally supplied the foundations and cornerstones of the homes and buildings in New England communities, the paving stones for almost all the streets constructed during the 1800s in Atlantic coastal ports, the blocks for a growing nation's industrial, commercial, and municipal buildings, and the monuments that glorified an endless supply of heroes. The technical basis for these glory days has passed, but new technical requirements may be the cornerstone of greater scientific understanding.

Half-Day

(held during the meeting)

32. Building Blocks of Boston.

Tuesday, October 26, 8:30 a.m. to 12:00 noon. Cosponsored by *New England Intercollegiate Geological Conference (NEIGC)*. Dorothy Richter, Hager-Richter Geoscience, Inc., 8 Industrial Way, Salem, NH 03079, (603) 893-9944; and Gene Simmons, Hager-Richter Geoscience, Inc. Limit: 24. Fee: \$20.

Boston has a rich heritage of building stone use since the construction of Kings Chapel, the oldest granite block building in the United States, in 1749. Until about 20 years ago, most of the building stone in Boston was supplied from New England and, to a lesser extent, other North American sources. However, as in most major cities, recent high-rise construction has included extensive installation of thin stone cladding, much of which is imported. During this half-day walking trip, we will examine historic

and modern uses of building stone in Boston. We will also visit a few sites where we can examine historic preservation of stone and some of the problems that can develop in modern building cladding. The trip will conclude at Boston's Faneuil Hall/Quincy Market where participants can have lunch on their own.

24. Boat Tour of Boston Inner and Outer Harbor and Islands.

Tuesday, October 26, 1:00 to 4:30 p.m. Cosponsored by *Association of Engineering Geologists, New England Section (AEG-NE)*. John T. Humphrey, Haley & Aldrich, Inc., 58 Charles St., Cambridge, MA 02141, (617) 494-1606; and Jutta Hager, Hager-Richter Geosciences Inc., Salem, New Hampshire. Limit: 110. Fee: \$15. Note: No guidebook or lunch is provided for this trip.

Come and spend the afternoon on the Cruise Ship M/V *Massachusetts*, which docks at beautiful Rows Wharf in downtown Boston. Speakers knowledgeable about the geology of Boston, the mega-construction projects, the environment, the history, and of course the beautiful scenery, will present ongoing narrations for a three-hour harbor cruise. The tour will not be overly technical and will be suitable for nongeological guests. The boat is roomy, with both enclosed and open areas, and has a snack bar. Pay parking and public transportation are close by, or an enjoyable walk to Rows Wharf through the historic Faneuil Hall Market area.

25. Petrologic and Age Relations of Igneous Rocks in the Pine Hill Area, Medford, Massachusetts. CANCELLED.

26. Geology of East Point, a Rocky New England Coastline.

Wednesday, October 27, 8:00 a.m. to 1:00 p.m. Cosponsored by *New England Intercollegiate Geological Conference (NEIGC)*. Richard H. Bailey and Martin Ross, Dept. of Geology, Northeastern University, 360 Huntington Ave., Boston, MA 02115, (617) 437-3181. Limit: 45. Fee: \$40.

A visit to East Point at Nahant, Massachusetts, about 15 miles north of Boston, will give participants several hours to examine sedimentary and igneous rocks exposed in coastal cliffs along a rocky promontory. Fossiliferous Early Cambrian mudstones and limestones are cut by numerous faults, mafic dikes, sills, and a gabbro pluton. The Cambrian strata are particularly significant because they contain the Acado-Baltic small shelly fauna that characterizes the Avalonian exotic terranes of eastern North America. The tectonic history and complex interrelations between the Ordovician Nahant Gabbro, several dolerite sills, and a northwest-trending mafic dike swarm will be evaluated in light of new mapping and geochemistry.

27. Engineering Geology and the Geology in Active Tunnel Projects in the Boston Area.

Wednesday, October 27, morning.

Two large-scale engineering projects involving substantial tunneling will be in progress in Boston during the GSA Annual Meeting. The first is the sewage treatment tunnel under Boston Harbor to carry sewage several miles offshore. The other project, the so-called Big Dig, is a multi-billion dollar project burying and expanding the current elevated highway through downtown Boston and adding a third harbor tunnel. A trip to study the geology and engineering of both of these projects is planned but will depend upon access to and progress of the projects. Therefore, registrations will be accepted at no charge on a tentative basis only. Confirmation and more information will be mailed by October 1 to those registering for the trip.

28. Coastal Geologic Hazards and Management Strategies Along a Complex Microtidal Coastline.

Thursday, October 28 through Sunday, October 31. Cosponsored by *New England Intercollegiate Geological Conference (NEIGC)* and *GSA Sedimentary Geology Division*. Jon C. Boothroyd, Dept. of Geology, University of Rhode Island, Kingston, RI 02881, (401) 792-2191; Christopher W. Galagan, Applied Science Associates, Inc., Narragansett, Rhode Island; and Denis E. Newcomer, Baker Environmental, Princeton, New Jersey. Limit: 43. Fee: \$295 (3 B, 2 L, 3 ON). Note: Overflight of coastline on Sunday can be arranged directly with leader for an additional \$50. This will be limited to 18 to 21 people, so contact Jon Boothroyd soon to sign up. The \$50 will be paid directly to the leader, not GSA.

The microtidal coastline of Rhode Island is composed of (1) open coast barrier spits, lagoons, and glacial headlands and (2) a complex of estuarine coves, small barriers, and varied headlands in Narragansett Bay. The coast is hurricane dominated, but it is also influenced by winter storms and a 30 cm/100 yr sea-level rise. The trip will illustrate geologic processes and the resulting geomorphic and sedimentologic changes and their impact on people. Various management strategies designed to lessen the impact of geologic processes will be illustrated, with a discussion of the usefulness of those strategies with regard to the goal stated. An important part of the trip will be a discussion of geologic hazards resulting from accelerated sea-level rise due to global warming. Participants will visit selected environments both on the open barrier-lagoon shoreline and on Narragansett Bay. An overflight of the coastline is planned if participants are interested. This trip is for coastal geomorphologists, environmental geologists, and coastal planners. Stops will be designed to appeal to people with in-depth knowledge of geologic processes as well as those with an introductory understanding only. The number of stops will be limited so that adequate time is allowed for discussion. Stops can be added or dropped as time permits.

29. Alleghanian and Avalonian Tectonism in Southeastern New England.

Thursday, October 28 through Sunday, October 31. Sharon Mosher, Dept. of Geological Sciences, University of Texas, Austin, TX 78712, (512) 471-4135; Daniel Murray and Don Hermes, University of Rhode Island; and L. Peter Gromet, Brown University, Providence, Rhode Island. Limit: 42. Fee: \$270 (3 B, 3 L, 2 D, 3 ON).

Southeastern New England contains the most complete record of the internides of the late Paleozoic Alleghanian orogeny, as well as several diverse Avalonian stratigraphies. This trip makes a transect across southeastern New England from eastern Connecticut to southeastern Massachusetts in which we will examine a variety of structural, metamorphic, igneous, and stratigraphic evidence for the Avalonian and Alleghanian orogenies. We will look at the depositional setting of the synorogenic fossiliferous Pennsylvanian-age Narragansett Basin, the subsequent Permian contractional and transcurrent deformation and Barrovian metamorphism of the basin sedimentary deposits, and the intrusive Permian meta-aluminous granite. We will also address the recent controversy over the evolution of the eastern margin of the Appalachian orogen that centers on the number of Avalonian terranes, the timing of their collision from Devonian to Permian, and the location and nature of the major tectonic boundaries. To do so, we will focus on the lithotectonic suites that make up the Avalon zone, the tectonic contact between Acadian metamorphic rocks of central New England and Avalon basement, and brittle-ductile shear zones proposed as major Alleghanian tectonic boundaries.

30. Geology and Geomorphology of the Acadian Orogen, Central Maine.

Thursday, October 28 through Sunday, October 31. Lindley S. Hanson, Dept. of Geological Sciences, Salem State College, Salem, MA 01970, (508) 741-6282; Dwight Bradley, U.S. Geological Survey, Alaskan Branch; and D. W. Caldwell, Boston University. Limit: 43. Fee: \$300 (3 B, 2 L, 3 D, 3 ON).

This trip offers a multidisciplinary approach to the regional geology and geomorphology of the Acadian orogen in central Maine. Many stratigraphic concepts that are applied in higher grade parts of the orogen to the south are merely extrapolations from central Maine, where the Silurian and Devonian rocks contain fossils and well-preserved sedimentary structures. The trip will visit two main pre-Acadian paleogeographic belts, the northwestern margin of the Kearsarge-central Maine deep-water basin and the adjacent Piscataquis magmatic arc. These belts had very different histories through Silurian time, but they share a Devonian flysch and olistostrome sequence that we interpret as having been deposited in a migrating Acadian foredeep. Throughout the trip we will discuss how the geomorphology and glacial geology reflect the underlying bedrock geology. Sites to be visited include Mount Katahdin, Ripogenus Gorge, Borestone Mountain, Mount Kineo, and Maine's only active slate quarry. Moderately strenuous hiking, brisk fall weather, and peak foliage should be anticipated.

31. Highlights of Metamorphic Stratigraphy and Tectonics in Western Maine to Northeastern Vermont.

Thursday, October 28 through Sunday, October 31. Robert H. Moench, U.S. Geological Survey, 905 Federal Center, Denver, CO 80225, (303) 236-5651. Limit: 45. Fee: \$255 (3 B, 3 L, 2 D, 3 ON).

This trip covers the basis for current interpretations of northern New England geology, resulting from six decades of geologic mapping and related studies by many geologists. Newly recognized stratigraphic and structural relationships suggest a tectonic model involving major Silurian strike-slip. On day 1, from Phillips northwest to Rangeley, Maine, we will cross an enormously thick sequence of Lower Devonian and Silurian metasedimentary rocks, mainly turbidites, in the Central Maine trough (CMT). This sequence is repeated, with changes, in a controversial feature now called Piermont-Frontenac allochthon seen later. Then, from Rangeley west to Oquossoc, Maine, we will pass through Ordovician volcanic arc and older flysch sequences of the Bronson Hill-Boundary Mountains anticlinorium. The anticlinorium is a fragment of the source area for Silurian deposits of the CMT. On days 2 and 3, from Oquossoc, Maine, to Piermont, New Hampshire, we will cross the anticlinorium and focus on the Piermont-Frontenac allochthon. The allochthon truncates the west side of the anticlinorium, and now appears to be composed of perhaps all the Silurian deposits of the Connecticut Valley trough to the west, and enigmatically, a Silurian sequence derived from some part of the CMT to the east. The trip examines the internal stratigraphy and structure of the allochthon; its boundaries and relations to the adjacent tectonic belts; and evidence bearing on its source, mode of transport, time of emplacement, and post-emplacement history.

33. Multiple Glaciations and Deglaciation of a Transect from Boston, Massachusetts, to the White Mountains, New Hampshire.

Friday, October 29 through Saturday, October 30. P. Thompson Davis, Dept. of Natural Sciences, Bentley College, 175 Forest St., Waltham, MA 02154-4705, (617) 891-3479; Woodrow Thompson, Maine Geological Survey, Augusta; Byron Stone, U.S. Geological Survey, Hartford, Connecticut; Robert Newton, Smith College, Northampton, Massachusetts; and Brian Fowler, Mount Washington Observatory, North Conway, New Hampshire. Limit: 41. Fee: \$160 (1 B, 2 L, 1 D, 1 ON).

On this trip we will examine drumlin exposures in northeastern Massachusetts that exhibit two tills separated by a weathering profile; glacial outwash features and eskers in central New Hampshire; and pre-glacial weathering profiles ("rottenstone"), glacial depositional features (till, erratics, moraines, alluvial fans, lake sediments), and erosional land forms (grooves, striations, potholes, roches moutonnées, cirques, U-shaped valleys, the "Old Man of the Mountains") in northern New Hampshire. Of particular interest will be (1) the "two-till problem," (2) the relative sequence of continental and cirque glaciation in the White Mountains, and (3) the mode and chronology of continental deglaciation. The trip is dedicated in memory of Richard P. Goldthwait.

34. The Avalon and Nashoba Terranes (Eastern Margin of the Appalachian Orogen in Southeastern New England).

Friday, October 29 through Sunday, October 31. Cosponsored by *New England Intercollegiate Geological Conference (NEIGC)*. Christopher Hepburn, Dept. of Geology and Geophysics, Boston College, Chestnut Hill, MA 02167, (617) 552-3642; Rudolph Hon, Boston College; Gregory Dunning, Memorial University, St. John's, Newfoundland; and Richard Bailey and Kenneth Galli, Northeastern University, Boston. Limit: 41. Fee: \$295 (2 B, 3 L, 2 D, 2 ON).

The classic Avalon zone of southeastern New England is best documented in the vicinity of Boston. Field trip stops will include the major lithologies of both the Avalon and the adjacent high-grade Nashoba terrane to the northwest. Petrogenesis of the magmatic rocks, stratigraphic arguments and recent zircon age determinations will be the focus of discussions within the context of the evolution of the geology of the Appalachian eastern margin from the late Precambrian through its final stages of amalgamation during the Paleozoic. Possible correlations with other Avalonian fragments in the Appalachians will serve as an additional motif for contention and dialogue. The first day will be spent looking at Avalonian igneous and sedimentary rocks north of Boston. The second day will be spent largely in the Nashoba terrane. On the last day, we will examine the late Proterozoic and early Paleozoic sedimentary rocks of the Boston basin (including the Squantum "tillite"), early Paleozoic peralkaline plutonic rocks, and exposures of the deformed Carboniferous cover.

35. Ground-Water Contamination and Solute-Transport Research at the U.S. Geological Survey's Cape Cod Field Site.

Friday, October 29. Denis LeBlanc, U.S. Geological Survey, Water Resources Division, 28 Lord Road, Suite 280, Marlborough, MA 01752, (508) 490-5030; and Kathryn Hess and Steven Coppola, U.S. Geological Survey, Marlborough. Limit: 43. Fee: \$55.

On this trip to Falmouth, Massachusetts, on Cape Cod (about 1.5 hours south of Boston), we will visit a research site where field studies on the transport and fate of contaminants in ground water are being conducted by the U.S. Geological Survey and several universities. At this site, 55 years of land disposal of treated sewage have created a plume of contaminated ground water that is more than 6 km long. The distributions of chemicals in the plume reflect the hydrologic, chemical, and microbio-



■ Bass Harbor, Maine. Photo by Bill Cronin.

logical processes that affect contaminants in the subsurface. The trip will include a stop in a gravel pit where more than 1000 multilevel wells are being used in ground-water tracer experiments with inorganic, organic, and microbial tracers. At several stops, field methods such as tracer tests and detailed vertical sampling of ground water and aquifer material will be demonstrated to highlight the effects of dispersion and geochemical processes on contaminant migration in the glacial outwash.

Field Trips for K-12 Teachers

SPONSORED BY GSA K-12 EDUCATION PROGRAMS COMMITTEE

Boston Harbor Explorations.

Sunday, October 24, 8:00 a.m. to 12:00 noon. Howard Dimmick, Stoneham High School, 149 Franklin St., Stoneham, MA 02180, (617) 438-5717. Limit: 49. Fee: \$30.

This is a Project Oceanography-sponsored trip on *EnviroLab III*, a new 19-m-long research and classroom vessel. Participate in a sample classroom trip offered to students grades four through college. Collect scientific data and samples and observe the microscopic world of Boston Harbor. Participants will receive samples and a handout along with information on bringing their classes on this trip. Dress warmly, as it is often cooler on the water than on land, and wear shoes that are appropriate for walking on a damp ship deck.

Coastal Geology North of Boston.

Sunday, October 24, 8:00 a.m. to 2:00 p.m. Eugene Boulay, McCall Junior High School, 458 Main St., Winchester, MA 01890, (617) 721-7020. Limit: 40. Fee: \$26 (1 L).

This trip is along the north shore of Boston Harbor. It is the same trip taken by the leader, Gene Boulay, with his middle school students. You will see roches moutonnées, drumlins, striations, exfoliation, sea caves, stacks, and shoreline development of beaches as well as longshore current evidence and the effect of sea walls, jetties, and breakwaters on current flow. The trip is outdoors, so a hat, gloves, warm jacket, and good walking shoes are a must.

Geology of the Boston Basin.

Sunday, October 24, 8:30 a.m. to 4:30 p.m. Richard Staley, F.A. Day Junior High School, 21 Minot Place, Newtonville, MA 02166, (617) 552-7379. Limit: 45. Fee: \$35 (1 L).

We will first visit scenic World's End at the southern edge of Boston Harbor. Evidence will be found of the boundary between the 630 Ma Dedham granite and the Late Precambrian (600 Ma) sedimentary and volcanic rocks deposited when this land was a part of present West Africa. After lunch, we will travel northwest to find evidence in Newton's Webster Conservatory Area of deeply cut channels filled with the famous Roxbury Conglomerate (pudding stone), and of lava that flowed on the surface and cooled. Dress in warm clothes, and wear good hiking shoes. Total hiking will be 2-3 miles.

SPONSORED BY NATIONAL ASSOCIATION OF GEOLOGY TEACHERS

Geosecrets of Downtown Boston: City Geology with a City Geologist.

Sunday, October 24, 9:00 a.m. to 12:00 noon. James V. O'Connor, Environmental Science Dept., University of District of Columbia, MS 44-04, 4200 Connecticut Ave., N.W., Washington, DC 20008, (202) 282-7373. Limit: 20. Fee: \$10.

Join a city geologist for a walking exploration of downtown Boston. Learn how to apply earth science principles to urban issues highlighted along a segment of the Freedom Trail. Observe and measure the geological secrets for numerous outcrops in the inner city. With time, within a few city blocks, sample the variety of geoconcepts while investigating streets, sidewalks, wall and floor stones, sewer lines, cemeteries, and land use. Earth science, discoverable in all cities, is an underutilized educational tool. City field trips are an excellent method to stimulate new perceptions about earth science related to daily life. This tour demonstrates how formal and informal education as well as exploration research should use the large volume of building outcrops in any city. City geology is a natural link of science, economics, social history, and politics. Read the urban landscape to discover sequences of modern historical geology.

Evolution of Cape Cod Landscapes: Marine and Glacial Field Techniques Applied to Cape Cod.

Saturday, October 30, 7:00 a.m. to 6:00 p.m. Cosponsored with *National Earth Science Teachers Association* and *National Marine Educators Association*. James V. O'Connor, Environmental Science Dept., University of District of Columbia, MS 44-04, 4200 Connecticut Ave., N.W., Washington, DC 20008, (202) 282-7373; Brian B. Tormey, Pennsylvania State University; Richard Williams, Jr., U.S. Geological Survey, Reston; and Robert N. Oldale, U.S. Geological Survey, Woods Hole. Limit: 35. Fee: \$40 (1 L).

This field exploration covers the landscape-evolution history of Cape Cod. Participants will observe and measure some glacial erosion and deposition features now being altered by human and ocean systems. They will investigate the dynamics of the coastal energy systems that destroy and create new habitat at coastal landforms. Discussions on the protection and management of these coastal zone communities is juxtaposed with the impacts of storms, ground water, and special ecological niches, such as bogs, marshes, kettles, and sandy tidal flats. The biogeological coastal oceanography of the bay, sound, and Atlantic shorelines of Cape Cod will be viewed and discussed. Stops include the shipping canal, Chatham Barrier beach, Orleans beaches, Nauset marsh, and numerous Cape Cod National Seashore geosecrets from Salt Pond to Race Point in Provincetown.



■ Photo by Bill Cronin.

Other Field Trips

SPONSORED BY SOCIETY OF ECONOMIC GEOLOGISTS

Registration and information on these two trips can be obtained from the leader listed for each trip.

Mineral Deposits of the Adirondack Mountains.

Tuesday, October 19 through Friday, October 22. Erich U. Petersen, University of Utah, Dept. of Geology and Geophysics, Salt Lake City, UT 89112-1183, (801) 581-7238. Limit: 24. Fee: \$390 for SEG members, \$420 for nonmembers (3 B, 3 L, 2 D, 3 ON). Registration cutoff: September 4. Trip begins and ends in Albany, New York.

The Adirondack Mountains have a rich mining history that began in 1812 and continues today. This excursion across the Adirondacks will visit classical mineral deposits at Gore Mountain (garnet), Lewis (wollastonite), Tahawus (ilmenite), and the Balmat-Edwards district (sphalerite, talc-tremolite, wollastonite, marble). Many of these deposits are geologically unique and represent some of the largest single concentrations of these types of ores in the United States and the world. We will explore the role that sedimentary, igneous, metamorphic, and hydrothermal processes have played in the genesis of these deposits. All but one of the seven mines to be visited are currently active.

Besshi-type Massive Sulfide Deposits of the Vermont Copper Belt.

Thursday, October 28 through Sunday, October 31. John F. Slack, U.S. Geological Survey, National Center, MS 954, Reston, VA 22092, (703) 648-6337; and Terry W. Offield, U.S. Geological Survey, Reston. Limit: 24. Fee: \$320 (3 B, 3 L, 3 D, 3 ON).

Trip participants will visit the Ely and Elizabeth volcanogenic massive sulfide deposits of the Orange County, Vermont, copper belt, which are considered excellent examples of Besshi-type deposits. The Ely mine was the chief source of the nation's copper during the 1850s, and the Elizabeth mine, discovered in 1793, is the largest producer of metals in New England. The trip includes regional geology of the complexly deformed and metamorphosed clastic metasedimentary and minor mafic metavolcanic rocks of the Connecticut Valley trough (Silurian and Early Devonian), visits to the Ely, Elizabeth, and Orange & Gove mines, and examination of drill core. Emphasis will be on structural and lithologic setting of the deposits, styles of premetamorphic seafloor alteration and exhalative sedimentation, and the relation of the deposits to submarine MORB-type volcanism.

PROFESSIONAL HORIZONS

GSA-Sponsored Continuing Education Courses

Would you like to learn something new, brush up on the latest, or refresh your knowledge of the basics? GSA's continuing education courses will be held immediately before and after the Annual Meeting in Boston and are open to members and nonmembers.

A course *only* registration fee of \$25 is required if you are not attending the meeting. This fee may be applied to a meeting registration if you decide to attend. Preregistration is recommended; on-site fee is \$30 additional. You may register for GSA courses on the Annual Meeting Preregistration Form.

PREREGISTRATION DEADLINE: SEPTEMBER 24
CANCELLATION DEADLINE: OCTOBER 1
FOR MORE INFORMATION CONTACT
EDNA COLLIS
GSA CONTINUING EDUCATION COORDINATOR

1. GIS and the Geosciences.

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

Geographic Information Systems (GIS) is crucial for today's geoscience research and projects. The volume of data readily available, new methods in effective field data input, analytical techniques, and the low cost of software and hardware make GIS a cost-effective—if not compelling—geoscience tool. Legislation is requiring digital data in government projects, and the volumes of data one must analyze in today's competitive industries require a thorough understanding of GIS technology. One thing is certain: *no* GIS does it all. This course will address the technology from a geoscience applications viewpoint. The problem thus dictates the technology and not vice versa. The course accommodates entry-level scientists, as well as geoscientists who work with the technology, and particularly those who have learned from using one or two systems and thus have a constrained view of the world of GIS. The course is taught in a computerized lecture theater and will demonstrate the topics covered with a multiplicity of systems (including Arc/Info, GRASS, IDRISI, AutoCAD, ArcCAD, Arc View, etc.) on PCs and work stations. Topics covered include:

- introduction and applications,
- data availability and format,
- field input,
- data models,
- rectification, map projections, and georeferencing,

- analytical methods in GIS,
- geostatistics,
- trends in GIS.

Faculty: **Richard L. Bedell, Jr.**, Technical Director of the GIS Center, Weston Observatory, Dept. of Geology & Geophysics, Boston College; M.Sc., GIS and Remote Sensing, University of London, M.Sc., Geology, University of Toronto.

Limit: 100. Fee: \$135, students \$115; includes course manual and lunch.

2. Urban Geology: Foundation for Inner City Health.

Saturday, October 23, 8:00 a.m. to 5:00 p.m.; Hynes Convention Center. Cosponsored by NAGT, NESTA, and Geoscience Education Division.

This course is intended to encourage teachers and state surveys to translate the role of geologic processes for environmental equity. This course is designed for the nonspecialist in four segments:

- to acquire quickly a background on the issues and trends for city science,
- to participate in a series of handy general investigations that apply principles to problems via case studies,
- to walk a city neighborhood and learn to assess the living textbook as a standard geological field trip,
- to discuss the method and resources necessary for conveying the value of city science to your city or educational community.

Faculty: **James V. O'Connor**, City Geologist of Washington, D.C., and Environmental Science Dept., University of the District of Columbia; M.S.T., Boston College. **Wallace R. White**, Earth Science Teacher, Mt. Hebron High School, Ellicott City, Maryland; M.S., Johns Hopkins University.

Limit: 25. Fee: \$145, students \$125; includes course manual and reception.

3. Asia: A Continent Built and Assembled Over the Past 500 Million Years.

Saturday, October 23, and Sunday, October 24, 8:00 a.m. to 5:00 p.m.; Park Plaza Hotel. Cosponsored by International Division.

Asia, unlike North America and the Gondwana continents, which formed mainly in the Precambrian, is a continent assembled during Phanerozoic time. This distinctive character provides the framework for the course. Stratigraphy, structure, mountain-building, igneous activity, minerals, and basin development, as well as climatic change, can all be related to a 500-million-year-long process of continent building and assembly that continues today. This course will prove comprehensible to all professional geologists and graduate students, as well as to senior undergraduates. Because much of the material is quite new and not all of it has been published, senior and experienced workers will find this course worthwhile. In addition, faculty who teach historical geology, regional geology or tectonics will find the course of great interest. Topics covered include:

- Asia as a continent constructed in the past 500 m.y.,
- Precambrian blocks of Asia and their history,
- older Paleozoic history,

- late Paleozoic events—assembly and collisions,
- paleo- and neo-Tethyan history,
- Himalayan collision and its effects as the culmination of Tethyan history,
- India and Arabia in the aftermath of Gondwana breakup,
- Mesozoic collisions, Cenozoic arcs, and marginal basins—northeast Asia and Southeast Asia
- East Asian arc and marginal basin systems,
- sedimentary basins related to the assembly of Asia, with emphasis on the tectonic setting and related evolution.

Faculty: **Kevin Burke**, Dept. of Geosciences, University of Houston; Ph.D., University of London. **A. M. Celal Şengör**, Dept. of Geology, Istanbul Technical University; Ph.D., State University of New York at Albany.

Limit: 50. Fee: \$230, students \$210; includes course manual and lunch both days.

4. Contaminant Hydrogeology: Practical Monitoring, Protection, and Cleanup.

Saturday, October 23 and Sunday, October 24, 8:00 a.m. to 5:00 p.m.; Park Plaza Hotel. Cosponsored by Hydrogeology Division.

ATTENTION STUDENTS: The Hydrogeology Division will SUBSIDIZE THE FIRST STUDENT 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 is for newcomers and entry-level professionals who are interested in practical contaminant hydrogeology as it is applied daily to soil and ground-water contamination problems. It emphasizes the consultant working approach to solving hydrogeologic problems of data collection, interpretation, and remediation as required by government regulation. This course will *not* include rigorous mathematical ground-water contamination modeling. Topics covered include:

- theoretical and practical elements of geologic and hydrogeologic investigations,
- subsurface drilling procedures and sampling,
- monitoring well construction,
- water-sampling techniques,
- transport and fate of contaminants—general concepts,
- data interpretation,
- aquifer analysis—general concepts,
- criteria for selecting monitoring and remediation procedures,
- site cleanup,
- regulations,
- client and budgetary considerations.

Case histories explore the application of investigation and remediation techniques for UST, CERCLA, and RCRA projects, siting of hazardous waste landfills, leaking underground tanks, and contaminated properties in several states.

Faculty: **Christopher M. Palmer**, Senior Hydrogeologist, Gen Tech Environmental, Inc., San Jose, California; M.A., California State University. **Jeffrey L. Peterson**, Environmental Consultant, Sonoma, California; M.S., California State University.

Limit: 40. Fee: \$270, students \$250; includes course manual and lunch both days.

5. Fracture Mechanics of Rock.

Saturday, October 23 and Sunday, October 24, 8:00 a.m. to 5:00 p.m.; Park Plaza Hotel. Cosponsored by Structural Geology and Tectonics Division.

This course is designed for *all* geoscientists, professional as well as graduate students, who want an in-depth introduction to modern methods of field interpretation of joints and fractured rock. Our goal is to introduce the principles of fracture mechanics and apply those principles to outcrop observations through a series of lectures, hands-on exercises, and informal discussion and problem sets. The main topics include:

- foundations of fracture mechanics, including analysis of stress concentrations in rock and application of Griffith's analysis to rock fracture,
- linear elastic fracture mechanics, including analysis of stress and displacement fields and crack propagation criteria as applied to rock,
- controls on crack propagation in rock, including analysis of the crack-tip process zone and growth of cracks in compression,
- geological case studies, including analysis of joint spacing, crack strain, and oil-field fractured reservoirs,
- discussion of contentious issues, including crack driving mechanisms, origin of regional fractures, and the influence of mechanical stratigraphy on fracture distribution.

Faculty: **Terry Engelder**, Dept. of Geosciences, Pennsylvania State University; Ph.D., Texas A&M University. **Michael R. Gross**, Dept. of Geology, Florida International University; Ph.D., Pennsylvania State University. **Mark P. Fischer**, Dept. of Geosciences, Pennsylvania State University, M.S., University of Tennessee.

Limit: 50. Fee: \$240, students \$220; includes course manual and lunch both days.



■ Composite dike cutting Devonian gabbro at Bickford Point, Maine. Mafic blocks and pillows commingled in granitic dike of silicic cumulate. Photo by Richard H. Bailey.

6. Alternative Pedagogies in Geological Sciences: A Workshop.

Sunday, October 24, 8:00 a.m. to 5:00 p.m.; Hynes Convention Center. Cosponsored by Geoscience Education Division.

This workshop will explore alternative teaching strategies and interdisciplinary views of earth studies that make geology more attractive, meaningful, understandable, and accessible to undergraduate students. These strategies are particularly appropriate for students who have, traditionally, not entered the geoscience profession, especially women and students of color. The emphasis is on active learning, peer interaction, and examination of the social and cultural context of geologic knowledge. These practical classroom-tested strategies can be applied in existing courses as well as in new, specially designed courses. They can be applied in large-enrollment classes with fixed auditorium-style seating as well as in small, intimate seminars. Topics covered include:

- cooperative learning—an extensively researched teaching method that, among other things, improves student achievement, motivation, self-esteem, and social skills,
- feminist pedagogies for inclusive science—the use of feminist theory of science and pedagogy for transformation of earth science curricula,
- cultural perspectives of Earth and environment—interdisciplinary approaches to examining the relations between humans and landscape.

Faculty: (alphabetically) **Ann Bykerk-Kauffman**, Dept. of Geosciences, California State University—Chico; Ph.D., University of Arizona. **Lauret E. Savoy**, Dept. of Geography and Geology, Mount Holyoke College; Ph.D., Syracuse University. **Jill S. Schneiderman**, Dept. of Geology, Pomona College; Ph.D., Harvard University.

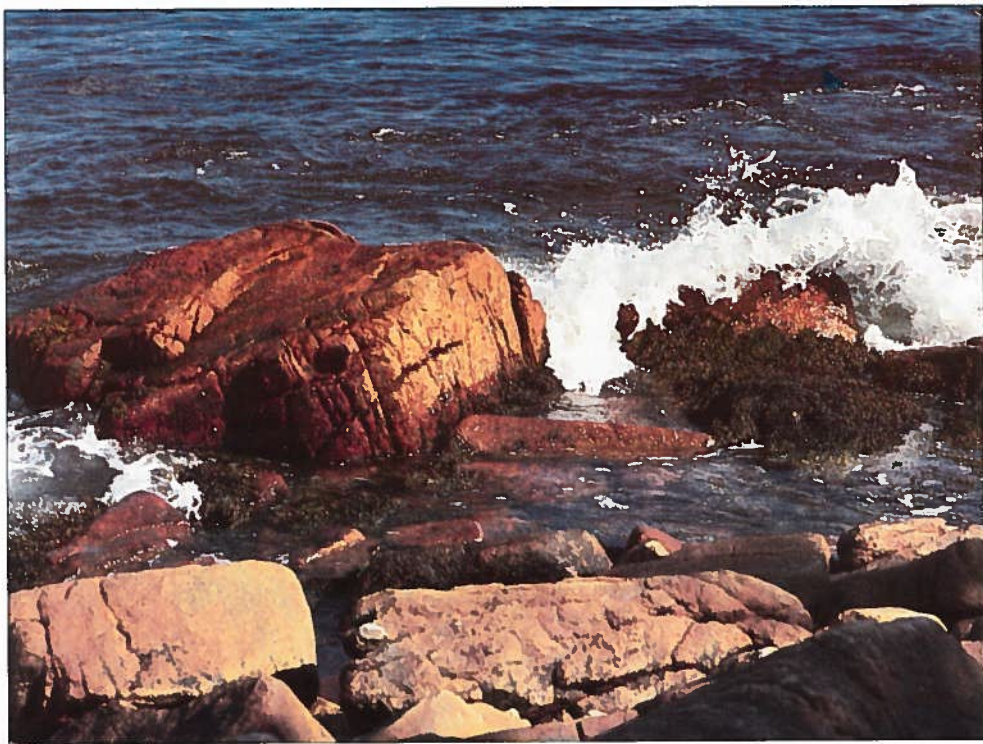
Limit: 40. Fee: \$150, students \$130; includes course manual and lunch.

7. Application of Sedimentological Information to Hydrogeological Problems.

Sunday, October 24, 8:00 a.m. to 5:00 p.m.; Hynes Convention Center. Cosponsored by Sedimentary Geology Division and SEPM (Society for Sedimentary Geology).

ATTENTION STUDENTS: The Sedimentary Geology Division will SUBSIDIZE ALL STUDENTS WHO ARE VALID DIVISION MEMBERS. The student MUST PAY THE FULL COURSE FEE when registering, but will be reimbursed \$50 after the GSA meeting by the Sedimentary Geology Division. To be reimbursed, students must apply in writing to Gordon S. Fraser, Indiana Dept. of Natural Resources, Geological Survey Division, 611 North Walnut Grove, Bloomington, IN 47405.

The goal of this course is to establish a framework for communication that promotes collaborative work between hydrologists and sedimentologists-stratigraphers. The course is designed to provide each participant



■ Acadia National Park, Maine. Photo by Bill Cronin.

with (1) an understanding of the type of hydrogeological information available through sedimentological investigations, (2) the quantitative format and the nomenclature that must be used to communicate this information from the sedimentological to the hydrogeological community, and (3) examples of ongoing collaboration. The course will be presented in four segments:

- introducing the problem by describing the motivation behind most hydrogeological investigations and the type of problems to which sedimentological tools can be applied,
- discussing specific hydrogeological data requirements, focusing primarily on unit boundaries, internal hydraulic properties, and methods of constraining extrapolation techniques based on "soft" geologic data,
- describing several methods currently used to acquire this type of information, such as areal and vertical mapping, multidimensional facies analysis, grain-size analysis, and descriptions of sedimentological processes,
- presenting examples of projects that promote successful cross-communication such as the new U.S. Geological Survey hydrogeological mapping initiative, research in hydraulic testing, new methods for defining parameters for fluid-flow simulations, and the U.S. EPA's efforts to produce a compilation of hydrogeological parameters for sedimentary systems. The majority of examples will be drawn from work in glacial sedimentary environments. However, a bibliography will be provided that lists similar types of work being performed in a variety of sedimentological settings.

Faculty: **Erik K. Webb**, Senior Member of Technical Staff, Sandia National Laboratories, Albuquerque, New Mexico; Ph.D., University of Wisconsin.

Limit: 50. Fee: \$150, students \$130; includes course manual and lunch.

8. Computer Mapping at Your Desk That Really Works.

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

This course will introduce participants to software for geological information visualization (GIV) and allow them to actually create on the computer map images from their own data sets. The course is aimed at those who have a basic familiarity with IBM-compatible computers (MS-DOS or PC-DOS operating systems). Several recently produced U.S. Geological Survey CD-ROMs, which contain digitized map data, will be demonstrated to show the range of software display capabilities. A copy of one of these disks will be supplied to each participant. Topics covered include:

- data sources,
- digitizing procedure,
- line fix and color fill,
- display tools,
- overlays,
- 3-dimensional visualization,
- linking of text, photographs, and maps.

Once these software-related topics have been covered by lecture and demonstration, participants will concentrate on *hands-on* practical applications of GIV tools. Participants are encouraged to bring a small map (up to 11" x 14") of their own to digitize and work with during this session.

Faculty: **Russell A. Ambroziak**, U.S. Department of the Interior, U.S. Geological Survey, Reston; Ph.D., University of Delaware. **Grant R. Woodwell**, Dept. of Chemistry and Geology, Mary Washington College; Ph.D., Yale University. **Renee E. Wicks**, U.S. Geological Survey, Reston.

Limit: 30. Fee: \$295, students \$275; includes course manual and lunch.

9. Environmental/Engineering Geology and Land-Use Planning—An Interface Between Science and Regulations.

Sunday, October 24, 8:00 a.m. to 5:00 p.m.; Hynes Convention Center. Cosponsored by Engineering Geology Division.

ATTENTION STUDENTS: The Engineering Geology Division will SUBSIDIZE THE FIRST FIVE STUDENTS WHO ARE VALID DIVISION MEMBERS. The student MUST PAY THE FULL COURSE FEE when registering, but will be reimbursed \$50 after the GSA meeting by the Engineering Geology Division.

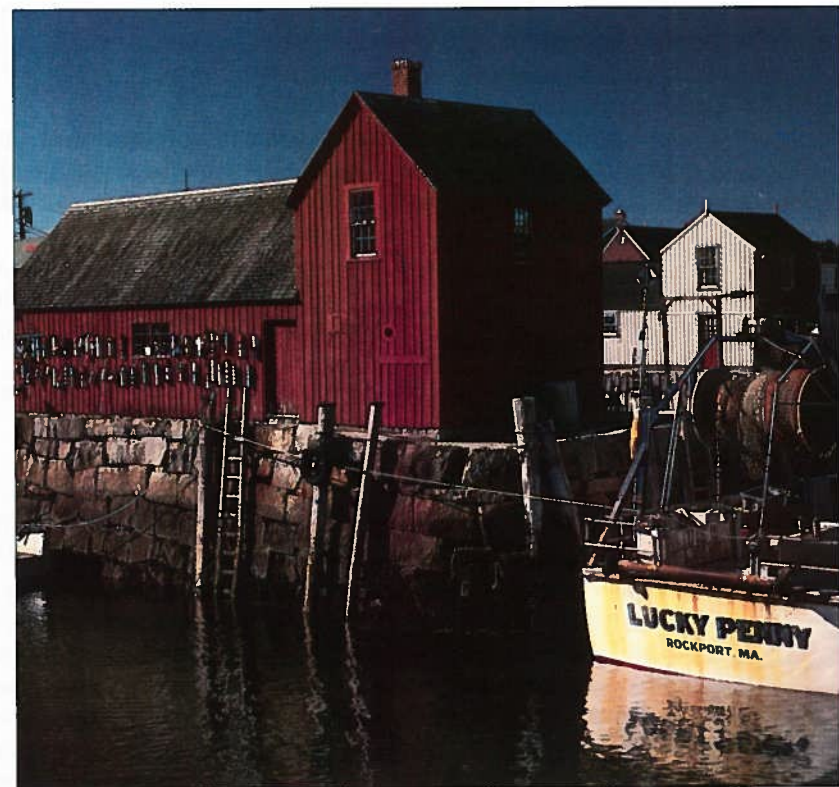
This course is aimed at those who are interested in understanding the use of geological principles in the regulatory context of land-use planning. Its purpose is to develop an improved understanding of how geological principles and simple data-gathering techniques can be incorporated into or guide land-use regulations. One emphasis will be upon concepts and sources of information. Another will be on information required for various types of land-use regulations and how this information can be applied to specific cases. Because of time constraints, a limited number of examples will be discussed, but from these should come an appreciation of broad principles. Topics covered include:

- NEPA and environmental impact statements,
- natural resource management regulations,
- coastal environment,
- slopes and land-use regulations,
- waste disposal,
- urban runoff,
- ground water,
- hazards vs. risks.

The ultimate objective of this course is to provide the participants with insights into how they may develop appropriate approaches to the solution of land-use planning problems in their communities.

Faculty: **Charles W. Welby**, Professor of Geology, Emeritus, North Carolina State University; Ph.D., Massachusetts Institute of Technology. **Jerome V. DeGraff**, Forest Geologist, USDA Forest Service; M.S., Utah State University. **Rhea L. Graham**, Director, Mining and Minerals Division, State of New Mexico Department of Energy, Minerals, and Natural Resources; M.A., Oregon State University.

Limit: 50. Fee: \$130, students \$110; includes course manual and lunch.



■ Red shack, Rockport, Massachusetts. Photo by Paul Corkum.

10. Geochemistry and Stable Isotopes of Paleosols.

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

Cosponsored by Sedimentary Geology Division and Geochemical Society.

ATTENTION STUDENTS: The Sedimentary Geology Division will SUBSIDIZE ALL STUDENTS WHO ARE VALID DIVISION MEMBERS. The student MUST PAY THE FULL COURSE FEE when registering, but will be reimbursed \$50 after the GSA meeting by the Sedimentary Geology Division. To be reimbursed, students must apply in writing to Gordon S. Fraser, Indiana Department of Natural Resources, Geological Survey Division, 611 North Walnut Grove, Bloomington, IN 47405.

To date, most studies of paleosols focus on the sedimentological and morphological features that permit recognition of them in the rock record and address their utility for reconstructing depositional histories and constraining determinations of paleoclimate. Geochemical studies of paleosols may yield a wealth of additional information on paleoclimate and paleoenvironment and a better understanding of the physical and chemical dynamics of soil formation. The objective of this course is to provide a starting point for geologists and sedimentologists who have

some familiarity with paleosol sedimentology or morphology to begin to consider the information that is contained in the geochemistry of paleosols. This course will provide an introduction to applied geochemistry, give practical instruction on how different interpretive models may be applied to geochemical and stable isotope data, and provide an opportunity to discuss some of the assumptions inherent in their application. Topics covered include:

- chemical changes during pedogenesis,
- choosing between common analytical methods (XRD, XRF, ICP, etc.),
- interpretive approaches to geochemical data (concentration ratios, mass-balance calculations),
- recognition of postpedogenic chemical changes such as hydromorphism and burial diagenesis,
- physicochemical environment of pedogenic calcite precipitation,
- controls on the carbon and oxygen isotope compositions of pedogenic carbonate,
- isotopic effects of postpedogenic alteration,
- interpretation of soil-water chemistry and paleoatmospheric $p\text{CO}_2$ from stable isotope compositions.

Faculty: **Claudia I. Mora**, Dept. of Geological Sciences, University of Tennessee; Ph.D., University of Wisconsin. **Steven G. Driese**, Dept. of Geological Sciences, University of Tennessee; Ph.D., University of Wisconsin. **David E. Fastovsky**, Dept. of Geology, University of Rhode Island; Ph.D., University of Wisconsin.

Limit: 50. Fee: \$175, students \$155; includes course manual and lunch.

11. Isotope Hydrology.

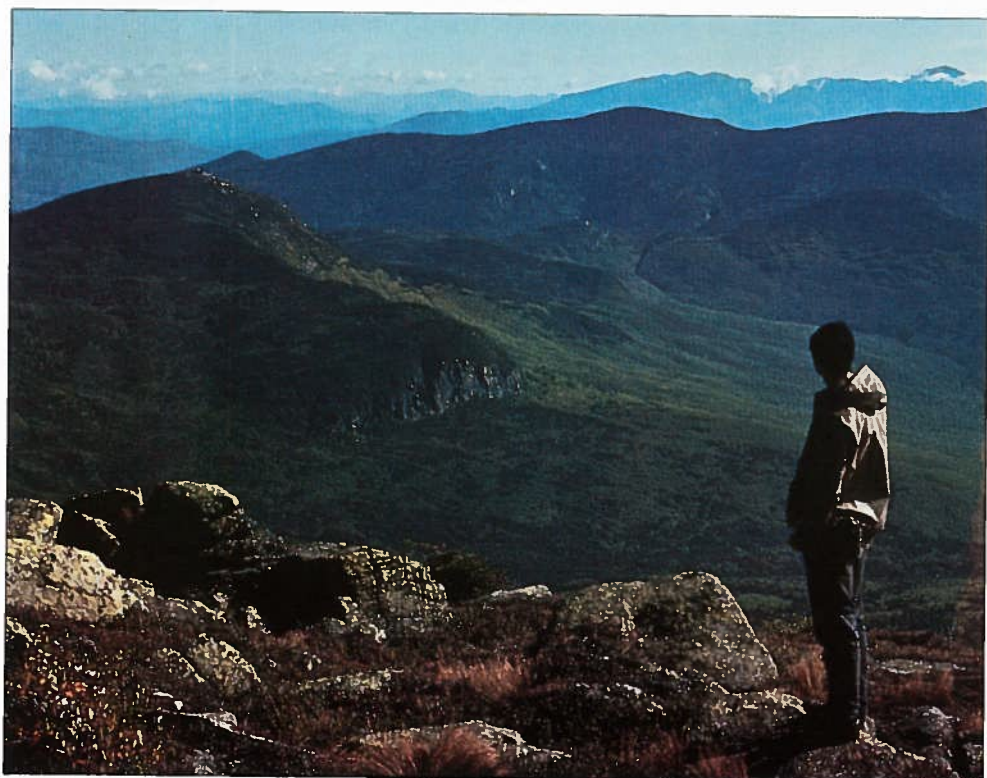
Sunday, October 24, 8:00 a.m. to 5:00 p.m.; Hynes Convention Center.

Cosponsored by Hydrogeology Division.

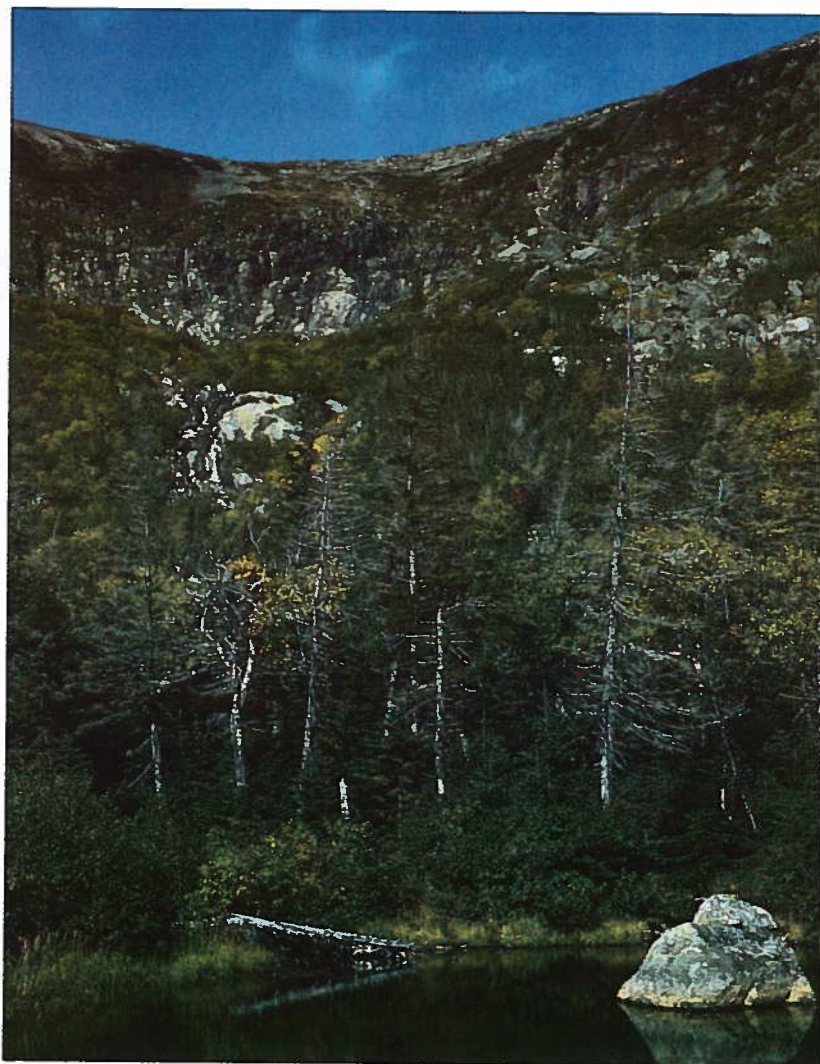
ATTENTION STUDENTS: The Hydrogeology Division will SUBSIDIZE THE FIRST STUDENT WHO IS A VALID DIVISION MEMBER. The student MUST PAY THE FULL COURSE FEE when registering, but will be reimbursed \$50 after the GSA meeting by the Hydrogeology Division.

This course will focus on *practical* applications of environmental isotopes for gaining a better understanding of hydrologic systems. The target audience is students and practicing geologists, hydrologists, and engineers with a senior undergraduate or graduate background in physical science who wish to apply isotope techniques to their work. Because a thorough understanding of the fundamentals is a critical prerequisite to successfully applying the methods, the systematics of isotope fractionation and the distributions of selected isotopes in natural systems will be discussed in detail. However, the main focus of the class will be on *applications* of isotopes, emphasizing applications where isotopes can be an especially cost-effective tool for tracing waters and solutes in hydrologic systems. Several problems presented in class will introduce the attendees to data analysis and interpretation, and there will be time for group discussions. Because one of the major obstacles to the use of isotopes is the unfamiliar terminology, a pre-course reading assignment will be distributed to all attendees. Topics covered include:

- fundamentals of isotope geochemistry—terminology, Rayleigh distillation, fractionations in open vs. closed hydrologic systems, etc.,
- hydrologic cycle—application of ^{18}O , deuterium, and tritium to tracing water sources,
- application of solute tracers (such as carbon, nitrogen, and sulfur isotopes) to determining pollutant sources and geochemical reaction paths,
- dating techniques— ^{14}C , tritium, etc.,



■ View northeast from Mt. Lafayette. Mt. Washington of Presidential Range is highest peak on horizon. White Mountains, New Hampshire. Photo by Richard S. Naylor.



■ Pond, Mt. Washington, White Mountains, New Hampshire. Photo by Bill Cronin.

- project design—sampling strategy, collection procedures, quality assurance of contract laboratories, and data analysis,
- case studies utilizing a multi-isotope approach.

The ultimate objective of this course is to outline some of the applications of environmental isotopes to hydrogeologic problems, so that students and professionals, who may not have an isotope laboratory available, can make better use of isotope techniques.

Faculty: **Carol Kendall**, Research Hydrologist, Water Resources Division, U.S. Geological Survey, Menlo Park; Ph.D., University of Maryland. **Neil L. Ingraham**, Desert Research Institute, Water Resources Center, University of Nevada Systems, Las Vegas; Ph.D., University of California, Davis.

Limit: 50. Fee: \$175, students \$155; includes course manual and lunch.

12. Fractals and Their Use in Earth Sciences.

Friday, October 29 and Saturday, October 30, 8:00 a.m. to 5:00 p.m.;

Park Plaza Hotel. Cosponsored by the Engineering Geology Division and the Geophysics Division.

ATTENTION STUDENTS: The Engineering Geology Division will SUBSIDIZE THE FIRST FIVE STUDENTS WHO ARE VALID DIVISION MEMBERS. The student MUST PAY THE FULL COURSE FEE when registering, but will be reimbursed \$50 after the GSA meeting by the Engineering Geology Division.

Fractal geometry provides a means of mathematically describing and modeling some of the complex patterns that earth scientists map, measure, and describe in ever-increasing detail. Fractal geometry is a branch of mathematics for quantifying how the geometry of patterns changes from one scale to another. It provides a powerful tool for analyzing the roughness, size distribution, density, or frequency of objects over a range of scales in time or space. Appropriate for government, academic, and industry earth scientists, including graduate students, this course is an introduction to the concepts of fractal geometry. Topics covered include:

- the concepts of self-similarity and self-affinity,
- stochastic fractals,
- generation of synthetic fractals,
- methods for measuring the fractal dimension of earth science data sets,
- fractals and probability.

The purpose of the course is to enable participants to comprehend the fractal literature and to measure the fractal properties of their own data sets. Participants are encouraged to present 10-minute summaries of their own work, applying fractal geometry, or to bring data sets that they would like to analyze.

Faculty: **Christopher C. Barton**, Research Geologist, U.S. Geological Survey, Denver; Ph.D., Yale University. **Paul R. LaPointe**, Senior Project Manager, Golder Associates, Inc., Redmond, Washington; Ph.D., University of Wisconsin. **Alberto Malinverno**, Research Scientist, Schlumberger-Doll Research, Ridgefield, Connecticut; Ph.D., Columbia University.

Limit: 50. Fee: \$290, students \$270; includes course manual and lunch both days.

Other Courses, Forums, and Workshops

Health Effects of Mineral Dusts.

Friday, October 22 through Sunday, October 24; Harbor House Resort and Conference Center on Nantucket. Sponsored by Mineralogical Society of America.

Although the asbestos minerals (fibrous serpentine and amphibole) are notorious as potential health hazards, several other mineral dusts have also been shown to be toxic, fibrogenic, and carcinogenic. The biochemical reactions that lead to disease occur at the mineral-fluid interface. Hence, a thorough understanding of mineral-induced disease requires an integrated approach that addresses mineralogical and geochemical concerns. This 2½-day short course will bring together experts in both the mineralogical and biological communities to discuss current issues in mineral-dust hazards.


Mineralogical topics will cover (1) natural occurrences and properties of minerals for which toxicological data have been determined, including structures, compositions, microstructures, and surface properties, (2) analytical techniques for characterizing biologically important properties, and (3) potential geochemical mechanisms. Biological topics will cover (1) epidemiology of mineral-induced disease, (2) biological activities of various minerals, as determined by *in vivo* and *in vitro* assays, and (3) biochemical mechanisms. Both areas will present sufficient introductory material for individuals outside of the discipline. The scientific aspects of mineral-related regulatory policies will also be discussed.

Two panel discussions are planned to allow exchanges between the speakers and audience. Panel discussions will cover policy-related topics and scientific topics, such as directions for future research. A poster session-reception will provide the opportunity for those who attend to present results of relevant current research.

The intended audience for this short course includes bioscientists and geoscientists actively involved in research on the health effects of minerals, individuals involved in formulating policies related to mineral regulations, and any individuals interested in an introduction to this topic.

Limit: 100. Preregistration required. For information and registration: MSA Business Office, 1130 Seventeenth Street, N.W., Suite 330, Washington, DC 20036, (202) 775-4344, fax 202-775-0018.

Earth Science Workshop for K-12 Teachers.

 Saturday, October 23, 8:00 a.m. to 5:00 p.m.; Hynes Convention Center. Sponsored by GSA and National Earth Science Teachers Association.

Participants will rotate through four 90-minute activity-based workshops in subject areas drawn from geology, astronomy, global environment, and meteorology. Workshops will be conducted by agents representing NSF (National Science Foundation)-funded projects, ESTEEM (Earth Science Teachers Exploring Exemplary Materials), SPICA (Support Program for Instructional Competency in Astronomy), IMAGE (Investigative Materials about Global Environment), and Project Atmosphere.

Limit: 100. No fee. Preregistration required. Please use the GSA preregistration form in this issue. For information: Beth Klocek, GSA headquarters.

Time and Taphonomy: Approaches to Time Resolution in Fossil Assemblages.

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

This course will focus on an aspect of fossilization of interest to a broad cross section of paleontologists and geologists: our current best estimates for the degree of time-averaging within fossiliferous deposits and for temporal resolution within fossiliferous sequences. The course is organized into three parts: (I) actualistic studies in modern environments, where we can calibrate fossil accumulations to absolute time-scales and determine whether these scales have distinctive taphonomic signatures; (II) quantitative simulations and analyses of synoptic data sets, where we use first principles to evaluate the effect of post-mortem mixing and of stratigraphic incompleteness on biological signals; and (III) stratigraphic case studies, illustrating the lines of reasoning used in estimating scales of time-averaging in the fossil record, and systematic patterns in the distribution of assemblages with different levels of resolutions. The course will cover terrestrial and marine environments, and plant, vertebrate, macroinvertebrate, and microfossil groups.

Faculty: Susan Kidwell, Anna K. Behrensmeyer, Gordon Baird, Carlton Brett, Robyn Burnham, Ralph Chapman, Hayes Cummins, Alan Cutler, Karl Flessa, Russell Graham, Kirk Johnson, Ronald Martin, Arnold Miller, Raymond Rogers, Peter Sadler, and Thompson Webb.

No fee or registration. Course notes will be available on site for approximately \$15. For information: Susan M. Kidwell, Dept. of Geophysical Sciences, University of Chicago, 5734 S. Ellis Avenue, Chicago, IL 60637, (312) 702-3008, fax 312-702-9505.


Minorities and Women in the Geosciences: Education, Recruitment, Professional Development.

Sunday, October 24, 9:00 a.m. to 2:00 p.m.; Marriott Hotel. Sponsored by Committee on Minorities and Women in the Geosciences.

This open forum will focus on strategies and programs in education and career development for minorities and women. We plan to have speakers plus a question and answer session to facilitate ideas and information within the Society. A series of panels on (1) challenges, opportunities, programs in pre-college education for women and ethnic minorities, (2) undergraduate and graduate education: school programs, recruitment efforts, enrollments, scholarships, and (3) minorities and women in the professional ranks: numbers, advancement, satisfaction, pay, professional societies will be presented. The final hour will be an open-floor discussion period to expand on issues raised during the panel presentations and to facilitate interaction and support among attendees.

Limit: 80. No fee. For information: Wes Ward, U.S. Geological Survey, MS 9540, 2255 N. Gemini Drive, Flagstaff, AZ 86001, (602) 556-7220, fax 602-556-7169.

Teaching Topics in Earth Science and Geology with Video as a Partner: For Secondary School Teachers.

 Sunday, October 24, 9:30 a.m. to 12:00 noon; Hynes Convention Center. Sponsored by Annenberg/CPB Project, National Association of Geology Teachers, and Southern California Consortium.

Explore how to use video modules with youngsters in your classrooms, making concepts of geology believable with examples drawn from the new PBS 26-part series, "EARTH REVEALED." Emphasis will be on the capability of the video to:



■ Covered bridge over the West River, West Dummerston, Vermont. Photo by J. Christopher Hepburn.

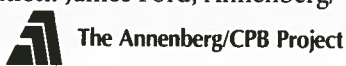


■ **Stromatolites exposed on glacial pavement. Cambrian Hoyt Limestone, Saratoga Springs, New York. Photo by William A. Newman.**

- provide visual imagery of dynamic processes important to geology, such as earthquakes, landslides, and erosion,
- offer vivid examples of strong links between understanding and solving geologic problems and meeting the needs of human society through common real-life applications,
- show role models of geologists and scientific research in action,
- fit flexibly into your lesson designs, serving to model, demonstrate, and explain a range of topics.

The workshop will include working in groups organizing inventive problem-posing approaches to a lesson on volcanism, earthquakes, or plate-tectonic theory, for example. The workshop will be led by James Sadd, Occidental College, of the academic development team for "EARTH REVEALED," together with a teacher who is using these video materials with secondary students.

Limit: 60. No fee. Preregistration required. Please use the GSA pre-registration form in this issue. For information: Janice Ford, Annenberg/CPB Project, 901 E Street, N.W., Washington, DC 20004, (202) 879-9655.



The Annenberg/CPB Project

Job Hunting and Career Development Skills for Geoscientists.

Sunday, October 24, 1:00 to 5:00 p.m.; Marriott Hotel. Sponsored by Association for Women Geoscientists.

Learn the job-hunting skills necessary to survive in today's changing job market, and to plan for future career development in your field, as well as related areas you may not have considered. Topics covered include the following:

- Networking gives access to the hidden job market that provides 85% of available employment but is not advertised. Learn to network through professional organizations as well as casual contacts.
- Résumé writing is a skill that provides the job seeker with the opportunity to get an interview. We are offering an excellent résumé-writing workbook for geoscientists.
- Interviewing skills are more important now than ever, and job opportunities may be unwittingly sabotaged during the interview process. Learn how to market and differentiate yourself from the competition.
- Attitudes for success derive from skills and strengths that job seekers may undervalue or be unaware they have. Revealing these boosts job-seeking efforts and results in successful interviews.

The workshop will include working in groups sharing skills and experiences that provide an interactive exchange, and the opportunity to change attitudes and methods that are no longer effective. The guarantee of future employment depends on the marketing skills of the individual and strategizing and positioning within the evolving job market.

Limit: 60. No fee. Preregistration required. Résumé-writing workbook: \$15. For information and registration: Tania Brice, Geoservices, Ltd., 1240 N. Mountain Road, Harrisburg, PA 17112, (717) 541-0799; or Leuren Moret, 962 South G Street, Livermore, CA 94550, (510) 449-7351.

Teaching Introductory Geology with Video as a Partner: For College Teachers.

Sunday, October 24, 1:30 to 4:00 p.m.; Hynes Convention Center. Sponsored by Annenberg/CPB Project, National Association of Geology Teachers, and Southern California Consortium.

Explore how to use video models to prompt students to interact with geology concepts, with examples drawn from the new PBS 26-part series, "EARTH REVEALED: Introductory Geology." Emphasis will be on the capability of the video to:

- provide visual imagery of dynamic processes important to geology, such as landslides, earthquakes, and sediment transport,

- offer vivid examples with lasting impact of strong links between the study of geology and the needs of human society,
- show role models of geologists and scientific research in action.

The workshop will include working in groups organizing inventive approaches to a lesson on plate tectonics or volcanism, for example. The workshop will be led by James Sadd, Occidental College, of the academic development team for "EARTH REVEALED," together with a teacher who is using these video materials in an undergraduate course.

Limit 60. No fee. Preregistration required. For information and registration: Janice Ford, Annenberg/CPB Project, 901 E Street, N.W., Washington, DC 20004, (202) 879-9655.



The Annenberg/CPB Project

Database Forum.

Sunday, October 24, 3:00 to 5:00 p.m.; Marriott Hotel. Sponsored by Geoscience Information Society.

This forum will focus on databases in a variety of formats (including CD-ROM, on-line, and floppy disks) useful to earth scientists and earth science librarians. Representatives of several databases will review the contents and search systems of their respective databases, as well as access for users. At press time, the subjects to be included in this year's forum are meteorology, oceanography, and interdisciplinary earth science information. Individuals in most disciplines in the geosciences will find at least one of the databases to be of interest. Producers of databases in these formats interested in participating should contact the organizer.

No fee or registration. For information: Kimberly Parker, Kline Science Library, Yale University, 219 Prospect Street, P.O. Box 6666, New Haven, CT 06511-8142, (203) 432-3443, fax 203-432-3441.

Introducing ... Contaminant Hydrogeology: A Workshop.



Tuesday, October 26, 8:00 a.m. to 12:00 noon; Hynes Convention Center. Sponsored by Hydrogeology Division.

The goal of this entry-level workshop is to introduce students and interested K-12 teachers to the exciting field of contaminant hydrogeology. The structured series of presentations will examine the processes by which contaminants spread in ground-water systems, and the variety of chemical and biological processes that may also influence transport. We will examine not only constituents dissolved in water, but also nonaqueous phase contaminants like gasoline or industrial solvents that are so prevalent at many sites.

Faculty: Franklin W. Schwartz, E. Scott Bair, Yu Ping Chin, and others (to be announced).

Limit: 150. No fee or registration. For information: Franklin W. Schwartz, Dept. of Geological Sciences, Ohio State University, Columbus, OH 43210-1002, (614) 292-6196, fax 614-292-0640.

Preparing Successful Grant Proposals to Fund Curriculum Innovation in the Geosciences.



Tuesday, October 26, 1:30 to 4:30 p.m.; Hynes Convention Center.

Sponsored by National Association of Geology Teachers and National Science Foundation.

Learn about the National Science Foundation programs that fund innovative instructional approaches in the sciences, discover the kinds of ideas that have worked well in the past (and those that have not), understand NSF's review procedures, and learn how to construct a successful proposal. Susan Hixson, Program Director at NSF, will review the programs available through the NSF Division of Undergraduate Education and criteria used to evaluate proposals. Participants will examine actual funded proposals, learning to recognize positive features that characterize outstanding proposals and fatal flaws that kill others. A panel discussion, led by Judith Hannah and featuring successful participants in the NSF Instrumentation and Laboratory Improvement Program, will solidify understanding of qualities that can make or break a proposal. Bring concerns for necessary improvements in your curriculum, and leave with concrete ideas about how to get the funding you need. This workshop is designed to build upon its companion symposium, S21: *Successfully Funded Laboratory and Field Technique Programs in the Geosciences.*

Limit: 50. Fee: \$10. Preregistration required. For information and registration: Judith Hannah, Dept. of Geology, University of Vermont, Burlington, VT 05405-0122, (802) 656-0245, fax 802-656-0045.

GeoRef Intermediate/Advanced Workshop.

Tuesday, October 26, 2:30 to 4:00 p.m.; Marriott Hotel. Sponsored by Geoscience Information Society and American Geological Institute.

Learn how to search AGI's GeoRef database more effectively on CD-ROM and on-line. Experienced geoscience librarians will share their ideas for effective searches. If you think your searches could be better at finding relevant entries from GeoRef's more than one million available references to geological literature, 1785 to the present, come to hear about some sample searches and special tips for searching. Bring questions and problem searches for group discussion and questions from the audience.

No fee or registration. For information: Marilyn Stark, U.S. Geological Survey Library, Box 25046, MS 914, Denver, CO 80225-0046, (303) 236-1004, fax 303-236-0015.



EXHIBITS



■ Past GSA Annual Meeting Exhibit Hall. Photo by Bill Cronin.

Charging into Future Technology

HYNES CONVENTION CENTER Second Level—Auditorium and Exhibit Hall C

Don't miss the excitement in the exhibits area. You will not find a wider variety of displays, all geared to the geosciences, than at this meeting. Browse around the 75,000 square feet of exhibits during the Welcoming Party on Sunday evening. But don't worry if you can't see it all then—three more days await you.

The exhibitors will be eager to show you their vast array of products and services. Imagine state-of-the-art computers, instrumentation, microanalysis, camera, and field equipment intermingled with fossils, gemstones, and mineral specimens! Pick up books, learn about the latest projects of governmental agencies, and visit with major universities about their programs. The model *Science Classroom of the Future* will certainly be the must-see exhibit of the 1993 meeting. For information, contact Becky Martin at GSA headquarters.

NEW AND EXPANDED EXHIBIT HOURS

Sunday	Monday	Tuesday	Wednesday	Thursday
October 24	October 25	October 26	October 27	October 28
5:00 p.m.—9:00 p.m.	9:30 a.m.—5:30 p.m.	9:30 a.m.—5:30 p.m.	9:30 a.m.—3:00 p.m.	CLOSED

Food and beverage service available during all exhibit hours plus

Boston Tea Party each afternoon.

Ye Olde GSA Pub will serve beer and sandwiches.

Meeting Exhibitors (at press time)

- | | | | |
|---|---|--|---|
| <ul style="list-style-type: none"> A.A. Balkema Publishers Academic Press Academy of Natural Sciences of Philadelphia Activation Laboratories Limited American Association of Petroleum Geologists American Geological Institute American Geophysical Union American Institute of Professional Geologists <i>American Journal of Science</i> ASC Scientific Association of American State Geologists Association of Engineering Geologists, New England Section Association for Women Geoscientists Blackwell Scientific Publications, Inc. Boston College Boston University Buehler, Ltd. Bureau of Economic Geology Cal Graeber Minerals Cambridge University Press Cameca Instruments, Inc. Chapman & Hall Chemical Abstracts Service Chempet Research Corporation Colorado School of Mines Columbia University Press Cushman Foundation for Foraminiferal Research Dapple Systems Desert Research Institute Donald K. Olson Minerals Earth'nWare, Inc. Economic Geology Publishing Company Elsevier Science Publishing Company, Inc. | <ul style="list-style-type: none"> EM&M's Gems Encyclopaedia Britannica North America ESRI—Environmental Systems Research Institute Europa Scientific Limited Finnigan MAT Fisons Instruments Friendship Publications General Supply Corporation Geochemical Society Geochron Laboratories Geographics Geological Association of Canada Geological Society of America—Bookstore Geological Society of America—Combined Publishers' Display Geological Society of America—Foundation Geological Society of America—Geology and Public Policy Committee Geological Society of America—GSA Journals on Compact Disc Geological Society of America—SAGE Program Geology Stuff Geoscience Information Society Gregg's Instrumentation Service Howard Minerals Ikon Mining INEL, Inc. International Association for Mathematical Geology JCPDS-ICDD JEOL U.S.A., Inc. J.L. Darling Corporation JOI/US Science Support Program Kendall/Hunt Publishing Company | <ul style="list-style-type: none"> Kluwer Academic Publishers Leco Corporation Leica Inc. Logitech Product Group of Struers Louisiana State University Macmillan Publishing Company Maine Geological Survey Micropaleontology Press Mineralogical Society of America Mountain Press Publishing Company National Association of Geology Teachers National Earth Science Teachers Association National Groundwater Association National Science Foundation Nature's Own Nikon Inc., Instrument Group Oklahoma Geological Survey Omni Resources Inc. Oxford Instruments, Inc. Oxford University Press Paleontological Research Institution Paleontological Society Pennsylvania Geological Survey Pergamon Press, Inc. Peterson-Scully Studios Philips Electronic Instruments Company Pikes Peak Lithographing Plenum Publishing Corporation Prentice-Hall Princeton University Press Rigaku/USA, Inc. Rocklabs Limited Rockware, Inc. Saunders College Publishing Scintag, Inc. SEPM (Society for Sedimentary Geology) Siemens Analytical X-Ray Instruments | <ul style="list-style-type: none"> Sigma Gamma Epsilon Society of Economic Geologists Soil Science Society of America Spectrex Corporation Spex Industries, Inc. Springer-Verlag New York, Inc. Tasa Graphic Arts, Inc. THE Company Treasures of Nature Ulrich's Fossil Fish University of Chicago Press University of Idaho University of Oklahoma U.S. Bureau of Mines U.S. Department of Energy—Environmental Restoration and Waste Management U.S. Department of Energy—Office of Civilian Radioactive Waste Management U.S. Department of Energy—Yucca Mountain Project U.S. Geological Survey W.H. Freeman & Company Washington State University West Publishing Company Wildlife Supply Company Wiley & Sons, Inc. William C. Brown Publishers Williams & Heintz Map Corporation Worth Publishers, Inc. Wright State University X-Ray Assay Laboratories |
|---|---|--|---|

SPECIAL PROGRAMS

Graduate School Information Forum

Monday, October 25 through Wednesday, October 27, 9:30 a.m. to 5:30 p.m.; Hynes Convention Center.

Students, this is a great opportunity for you to search for the right graduate school program to suit your interests. Come to Boston and meet with representatives from your favorite schools without spending the travel time and money to go to each school for information and interviews.

University representatives will be on hand to answer questions and talk to (primarily) undergraduates. Graduate students may also find this service helpful. Individual appointments are not necessary, although students are welcome to contact the schools in advance and schedule a meeting time. A complete list of participating schools with contact names and telephone numbers is available. The deadline for schools to register for the forum is July 15. If you would like to participate or receive the list, please contact Matt Ball, GSA headquarters.

Preliminary Schedule

Look for a complete list of schools in the September *GSA Today*

Participating Schools	Monday October 25	Tuesday October 26	Wednesday October 27
Bryn Mawr College		•	•
Cornell University	•	•	•
Georgia State University	•	•	•
New Mexico Tech		•	
Notre Dame	•	•	•
University of Alaska, Fairbanks		•	
University of Maryland at College Park	•	•	•
University of North Carolina at Chapel Hill		•	
University of North Dakota	•	•	
University of Pennsylvania		•	•
University of Tennessee	•		
University of Texas at Arlington	•	•	
Texas Christian University	•	•	•
Yale University	•	•	•

Employment Service

Monday, October 25 through Wednesday, October 27, 8:00 a.m. to 5:00 p.m.; Hynes 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 interested organizations seeking qualified earth scientists to fill staff needs are urged to submit notices of their vacancies and their requests for computer listings of applicants in advance of the meeting. The minimum fee for a printout of two specialty listings is \$150.

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 one-year registration fee is \$30 for GSA Members and Student Associates; \$60 for nonmembers. This applicant fee also includes the interview service at the annual meeting.

Applicants who sign up with the Employment Service by August 30, 1993, will be included in the information that employers receive prior to the meeting, so submit your forms early to receive maximum exposure, and remember to indicate on your application form that you would like to interview in October.

Employment Service forms are in the February and July 1993 issues of *GSA Today* or may be obtained by contacting the Membership Services department at GSA headquarters.

EMPLOYMENT OPPORTUNITIES IN THE GEOLOGICAL SCIENCES ROUNDTABLE DISCUSSIONS

Sunday, October 24, 12:00 noon to 2:00 p.m.; Hynes Convention Center.

Two years ago, the annual forum on employment opportunities in the geosciences was changed to allow more one-on-one interaction between panel members and individuals or small groups. This change has proved very successful and will be continued at this year's meeting. Experts in each of the areas listed below will conduct their 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 EMPLOYMENT SERVICE OR THE ANNUAL MEETING 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 1993 booklet "Future Employment Opportunities in the Geological Sciences."

Roundtable discussion leaders from the following areas will be featured: Academic and Educational (including two-year colleges), Mining, Federal Government, State and Local Government, Petroleum, Consulting, and Federal Legislation and Environmental Restoration.

For further information contact T. Michael Moreland, Membership Services Manager, GSA headquarters.

GSA and Boston College Host Top Seniors

GSA and Boston College will be sponsoring a group of top undergraduate seniors during the Annual Meeting. This program, now in its third year, has been a great success with the invited students and faculty of sponsoring universities. Arrangements have been made by GSA to fund housing and registration fees for these select Top Seniors. Boston College will serve as host to these seniors by providing a local field trip and a dinner reception. Travel expenses will be paid for by the student's university.

The program exposes the best and brightest of the seniors to the broad range of career opportunities in geology. The students get a chance to meet with professionals in various fields and to learn about the latest research. The students are also given the opportunity to look for a graduate school during the Graduate School Information Forum.

By necessity, this program has been carried out by invitation only. Each North American university with a geology department has been included in a database. Universities that have participated in the past are not included in the invitation list until all universities have had a chance to participate. Schools within 200 miles of the host city are not invited. Seventy-five schools have been invited to participate in 1993. The first 34 schools to respond will be sending Top Seniors to Boston.

Funding has been provided by GSA, Boston College, J. Wiley & Sons, Inc, and other sponsors. If you wish to assist with financial sponsorship for these students, please contact the Top Seniors Chairman, David Roy, Dept of Geology, Boston College, Chestnut Hill, MA 02161, (617) 552-2462, or Matt Ball, GSA headquarters.

Geology and Public Policy Forum

Geoscience Legislation in Congress

Tuesday, October 26, 12:00 noon to 1:30 p.m.; Hynes Convention Center.

The annual GSA Geology and Public Policy Committee forum will provide an overview and analysis of recent and pending geoscience legislation. Congress has been actively involved with science and technology issues in general, and geoscience issues in particular.

Geoscience legislation passed by Congress last year includes the National Geologic Mapping Act, Landsat Policy Act, and Energy Policy Act. Among the geoscience issues currently pending before Congress are amendments to the Mining Law of 1872, and legislation to reauthorize the Clean Water Act, National Earthquake Hazard Reduction Program, National Science Foundation, Safe Drinking Water Act, and Superfund hazardous waste cleanup program. In the forum speakers will discuss the implementation of recently enacted geoscience legislation and provide an overview of the status of pending legislation.

Many science policy experts believe that the end of the Cold War may be as significant as the end of World War II with regard to national science and technology policy. Federal agencies and national laboratories are redefining their mission and restructuring their operations in response to recent domestic and international developments. For example, President Clinton has abolished the Council on Environmental Quality, seeks to elevate the Environmental Protection Agency to cabinet status, and plans to announce the formation of a National Biological Survey modeled after the U.S. Geological Survey. The geoscience community needs to play an active role during this critical period.

The forum will be a panel discussion format. It is the nineteenth in the series and is open to everyone, including guests and the general public, with no cost or registration.

Earth Scientists on Capitol Hill

Tuesday, October 26, 1:30 to 2:30 p.m.; Hynes Convention Center.
Sponsored by GSA Geology and Public Policy Committee.

The GSA Congressional Science Fellowship program places scientists on the staffs of congressional offices. While gaining first-hand experience with the federal legislative process, Congressional Science Fellows participate in the drafting of public policy by providing scientific and technical expertise. Several of the previous fellows have accepted positions in Washington, D.C., and continue to provide to Congress a much-needed perspective of earth sciences.

As GSA's seventh Congressional Science Fellow, Margaret Goud Collins began the legislative year on the staff of U.S. Senator Max Baucus (D—MT). When Senator Baucus assumed the chair of the Senate Committee on Environment and Public Works, Goud Collins moved to the committee staff, where she has been working on international environmental issues, including aspects of the North American Free Trade Agreement.

At this open session, Goud Collins will report about her experiences on the Hill. Geology and Public Policy committee members will comment on how scientists can provide expertise to the U.S. Congress, the role of the GSA Fellow program, and the process to apply for the fellowship. Previous Congressional Science Fellows will also participate in the session.

Funded by GSA and by a grant from the U.S. Geological Survey, the GSA fellowship demonstrates the value of science-government interaction, and relates the need for informed involvement to the earth science community.

🍏 Educational Programs for K–12 Teachers

Preregistration fee for K–12 teachers is \$15. On-site registration fee is \$25. Appropriate ID is necessary. Preregistration for field trips and limited-enrollment events is required. For registration materials and additional information, contact Beth Klocek, GSA headquarters; Margaret D. Thompson, 1993 GSA Annual Meeting Education Coordinator, Dept. of Geology, Wellesley College, Wellesley, MA 02181; or Richard Staley, Dept. of Earth Sciences, F. A. Day Junior High School, Newtonville, MA 02160.

Additional information can be found in this announcement as indicated below. All programs dedicated to K–12 education in this publication are designated by 🍏.

Earth Science Workshop for K–12 Teachers

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

Urban Geology: Foundation For Inner City Health

Saturday, October 23, 8:00 a.m. to 5:00 p.m. Cost: \$145. See GSA-Sponsored Continuing Education Courses.

Boston Harbor Explorations

Sunday, October 24, 8:00 a.m. to 12:00 noon. Cost: \$30. See Field Trips.

Coastal Geology of North Boston

Sunday, October 24, 8:00 a.m. to 2:00 p.m. Cost: \$26. See Field Trips.

Alternative Pedagogies in Geological Sciences: A Workshop

Sunday, October 24, 8:00 a.m. to 5:00 p.m. Cost: \$150. See GSA-Sponsored Continuing Education Courses.

Geology of the Boston Basin

Sunday, October 24, 8:30 a.m. to 4:30 p.m. Cost: \$35. See Field Trips.

Geosecrets of Downtown Boston: City Geology with a City Geologist

Sunday, October 24, 9:00 a.m. to 12:00 noon. Cost: \$10. See Field Trips.

Teaching Topics in Earth Science and Geology with Video as a Partner: For Secondary School Teachers

Sunday, October 24, 9:30 a.m. to 12:00 noon. See Other Courses.

Teaching Introductory Geology with Video as a Partner: For College Teachers

Sunday, October 24, 1:30 to 4:00 p.m. See Other Courses.



Science Classroom of the Future

Sunday, October 24 through Wednesday, October 27. See Exhibits.

Beyond Student Literacy: How to Create an Earth-Literate Public*

Monday, October 25. See Technical Program, Symposium S20.

NAGT Luncheon

Monday, October 25. Cost: \$23.

Earth Science Information "Share-a-thon"

Monday, October 25, 5:30 to 6:30 p.m.; Hynes Convention Center.

This workshop is to promote the sharing of teacher-developed earth science materials and ideas with other teachers. Teachers will be presenting earth science teaching methods that they have successfully used in the classroom. Presenters will be stationed so that participants can circulate freely. Each station will have explanatory materials available. If you would like to be a presenter, please check the appropriate box on the GSA Registration Form in this issue.

Earth Science Social Hour

Monday, October 25, 8:00 to 10:00 p.m.; Marriott Hotel.

Join us for an informal networking session for K–12 teachers and other earth science educators. We want to hear your ideas, activities, and suggestions for improving earth science education. Also let us know what you think of our Boston meeting educational programs. Cash bar.

Successfully Funded Laboratory and Field Technique Programs in the Geosciences*

Tuesday, October 26. See Technical Program, Symposium S21.

Introducing ... Contaminant Hydrogeology: A Workshop

Tuesday, October 26. See Other Courses.

GSA Geoscience Education Division Luncheon

Tuesday, October 26. Cost: \$23.

Preparing Successful Grant Proposals to Fund Curriculum Innovation in the Geosciences

Tuesday, October 26, 1:30 to 4:30 p.m. Cost: \$10. See Other Courses.

Teaching Mineralogy*

Wednesday, October 27. See Technical Program, Theme Topic T3.

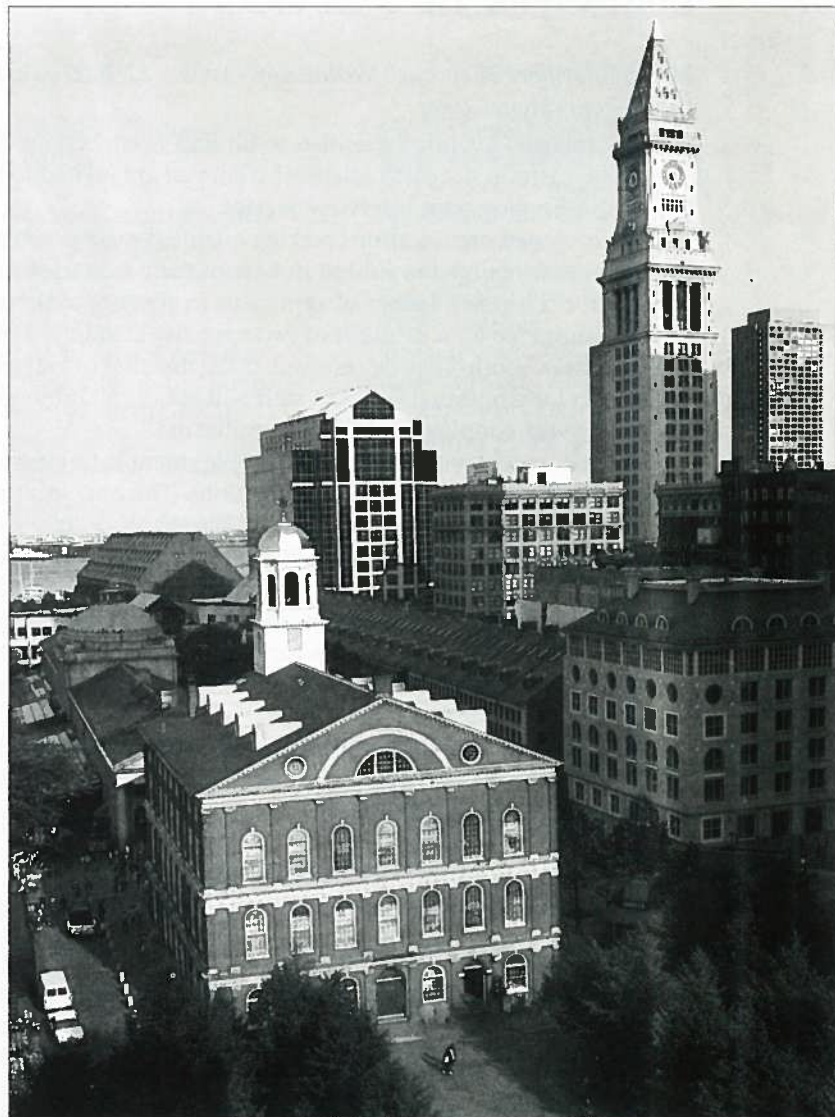
New Developments in Quaternary Geology: Implications for Geoscience Education and Research*

Wednesday, October 27. See Technical Program, Theme Topic T41.

Evolution of Cape Cod Landscapes: Marine and Glacial Field Techniques Applied to Cape Cod

Saturday, October 30, 7:00 a.m. to 6:00 p.m. Cost: \$40. See Field Trips.

* Symposia and Theme Sessions are subject to scheduling by the Joint Technical Program Committee. Consequently, days and times may change. See the September *GSA Today* for the final technical program schedule.



■ Custom House Tower and Faneuil Hall. Photo courtesy of Boston Convention and Visitors Bureau, Inc.

DIVERSIONS

Guest Program

Boston invites you to explore its history, culture, and possibilities for the future. For more than three and a half centuries, Boston has been a center of change and progress. You can walk in the footsteps of Paul Revere, Benjamin Franklin, and Henry David Thoreau, visit the homes of Louisa May Alcott, Nathaniel Hawthorne, and Ralph Waldo Emerson, follow the Freedom Trail, and visit the Boston Tea Party ship. Architecture, shopping, sports, and restaurants of every description make Boston an exciting city. You don't need a car—Boston is a great city for walking. Be prepared to enjoy the spectacular fall foliage colors too. Come to Boston and feel the excitement of the past, the present, and the future. It's a city with something for everyone!

Guests are invited to visit the GSA Hospitality Room, located in the Regis Room in the Marriott Hotel. Your hosts will be providing a Resource Center to help you explore *your* interests. Abundant information on Boston and surrounding areas will be available, as well as details on GSA seminars and tours. We will be serving light refreshments throughout the day, so please stop by. Please remember to wear your GSA badge and to bring your gift coupon, so you can receive your registration gift.

Sunday	1:00 p.m. to 5:30 p.m.
Monday	8:00 a.m. to 4:30 p.m.
Tuesday	7:45 a.m. to 4:30 p.m.
Wednesday	8:00 a.m. to 4:30 p.m.
Thursday	8:00 a.m. to 1:00 p.m.

Guest Welcoming Reception

Sunday, October 24, 4:15 to 5:00 p.m.; Marriott Hotel, Regis Room

Join us for a special reception to welcome you. Guest registrants, don't forget to bring the coupon enclosed in your registration packet for a glass of wine or soda. There will be a cash bar available as well. Plan to meet old and new friends in the Hospitality Room. All registrants are welcome.

FORMAL TOURS

Tours will leave the Marriott Copley Place from the main lobby side entrance. Reservations for all tours will be accepted on a first-come, first-served basis, so please register early. Space is limited and these trips will be popular, so be sure to preregister. Our tour operator requires a guarantee several days in advance, so don't wait until you arrive in Boston to register for these trips. We hope you will join us.

Because many people will be arriving in Boston early, we have planned two Sunday tours ideal for getting acquainted with Boston. **All GSA meeting registrants are welcome to participate in any of the tours offered.** You might want to also consider Field Trip #24, Boat Tour of Boston Inner and Outer Harbor and Islands, on Tuesday, October 26. See the description under Field Trips.

Bird Watching

Sunday, October 24, 6:45 a.m. to 5:00 p.m.

For avid bird watchers, a field excursion to Parker River National Wildlife Refuge on Plum Island has been planned. Add eastern species to your list—shorebirds, seabirds, raptors, and possibly even a snowy owl. You will want to wear warm clothing and bring binoculars. A local expert and a few scopes will be provided.

Cost: \$30 (includes guide, transportation, box lunch).

Boston Overview

Sunday, October 24, 12:15 to 4:15 p.m.

This tour is designed to touch *briefly* on Boston's most famous sites. Later you will feel comfortable visiting these places on your own. We will begin with a visit to Cambridge, steeped in tradition, history, and academic life, as we see Harvard Square, Tory Row, Harvard Yard and University, Widener Library, M.I.T., and the Charles River. Then on to Boston for a look into the old and new, visiting important landmarks. We will see refurbished Back Bay, famous "Art Square," and the Public Gardens. Touring charming Beacon Hill, one of the oldest parts of the city, we will see many historical sites including Federalist mansions, the State House, Boston Common, and the Boston Athenaeum. Many of the fascinating historic Freedom Trail sites are on this route. Use this overview to plan your week.

Cost: \$20 (includes professional guide, transportation).

Bravo Boston GSA Chorale



Tuesday, October 26, 7:00 to 10:00 p.m.; Jordan Hall at New England Conservatory of Music

This year one of the special events for the GSA Annual Meeting is indeed very special. Many of you may recall the performance by the 1988 GSA Centennial Orchestra of geologists in Denver, heard on and praised by National Public Radio. Once again musical geologists will have the opportunity to come together, this time in a dazzling choral performance in Boston, where the musical arts are a thriving part of the city's culture.

The performance will take place in the intimate and cherished Jordan Hall, treasured for its turn-of-the-century architecture, renowned for its excellent acoustics, and widely used by recording companies and famous artists. The hall is on the campus of the New England Conservatory of Music, an easy 10-minute walk from the Hynes Convention Center and the Marriott Hotel. The Bravo Boston GSA Chorale will perform the melodic and moving Mozart Requiem, popularized in the film *Amadeus*, with a professional orchestra and conductor. In addition, the performance will feature two double concertos by Vivaldi, featuring your musical colleagues as soloists. This is an evening not to be missed!

For those wishing to sing with the Bravo Boston GSA Chorale, contact Holly Stein, U.S. Geological Survey, MS 981, National Center, 12201 Sunrise Valley Drive, Reston, VA 22092, (703) 648-5326. You must be an active, accomplished singer who reads music. **Spouses and guests, particularly those with soprano and alto voices, are also welcome.**

For those wishing to attend this very special performance, ticket purchase in advance is highly recommended. Seating is limited, and given the sell-out performance by the GSA Centennial Orchestra, a ticket purchase with your meeting preregistration assures you a seat. You won't want to miss the excitement!

Transportation. Jordan Hall is within walking distance of the Marriott, Lenox, Copley Square, Hilton, and Colonnade hotels. Bus service will not be provided; however, taxi service will be available.

Cost: Concert only \$18; Concert with Reception \$28.

PRE-CONCERT WINE AND CHEESE AT THE COLONNADE

5:30 to 6:30 p.m.; Colonnade Hotel

As a special addition to this special evening, join us for wine, cheese, and other tasty hors d'oeuvres just before the concert.

A glass of wine and hors d'oeuvres come with the fee. Additional drinks will be on a cash basis.

The Colonnade Hotel is located conveniently between the Marriott and Jordan Hall.

Historic Homes Walking Tour—Beacon Hill

Monday, October 25, 9:15 a.m. to 12:15 p.m.

Travel back in time to Federal townhouses and Victorian mansions as you visit two gracious homes of Boston. This private tour will give you a unique glimpse of early nineteenth century life. Beacon Hill is known for its wrought iron balconies, magnificent doorways, colorful window boxes, red brick sidewalks, and cobblestone streets. Please wear comfortable walking shoes.

Cost: \$26 (includes professional guide, and admissions).

Newport, Rhode Island

Tuesday, October 26, 8:00 a.m. to 4:30 p.m.

Newport, the city by the sea, encompasses everything from colonial homes to the sumptuous mansions of the Gilded Age. This tour will combine nature's beauty and historic landmarks. We will visit Bellevue Avenue, perhaps the most lavish 3-mile stretch of real estate in America, where the Vanderbilts, Astors, and Belmonts lived. We will tour The Breakers, a mansion resembling a sixteenth century northern Italian palace built for Cornelius Vanderbilt. The tour will take us along scenic Ten Mile Ocean Drive before we stop at historic Bowen's Wharf for shopping and to see the lovely boutiques and art galleries. Enjoy lunch on your own at one of the charming restaurants in the area. Our last stop will be Hammersmith Farm, childhood summer home of Jacqueline Bouvier (Kennedy Onassis). It is locally referred to as the Summer White House, as it was frequented by John F. Kennedy and his family during summers in the early 1960s.

Cost: \$48 (includes professional guide, admissions, transportation).

Walking Tour of Newbury Street, Copley Square, and Boston Public Gardens

Tuesday, October 26, 9:00 to 11:15 a.m.

This walking tour of three special areas in Boston's Back Bay very near the Marriott will follow a seminar on their history (see Seminars). We will see the Trinity Church, designed by world-renowned architect Henry Richardson in 1890. We will also visit the Boston Public Library, often referred to as the Palace of the People. This elaborate landmark was built in 1887 for the common person to enjoy. We'll stroll through the Boston Public Gardens, enjoying the colors, rare trees, and ambience that inspired Robert McCloskey when he wrote *Make Way for Ducklings*. Please wear comfortable walking shoes.

Cost: \$8 (includes guide, seminar).

Cambridge's Botanical Museum and Isabella Stewart Gardner Museum

Tuesday, October 26, 12:30 to 4:30 p.m.

Our first stop will be the outstanding Botanical Museum, famous for its Ware Collection—more than 800 species of flowers represented in hand-blown glass. Next, we will tour one of Boston's treasures, the fabulous Isabella Stewart Gardner Museum, a Venetian palace with a personal, eclectic, and extraordinary collection of paintings, sculptures, tapestries, stained glass, furniture, tiles, and gargoyles. Be prepared for a memorable and delightful day.

Cost: \$33 (includes professional guide, admissions, transportation).

Lexington and Concord, Historic Literary Trail

Wednesday, October 27, 8:30 a.m. to 4:00 p.m.

We will trace the route of patriots William Dawes, Samuel Prescott, and Paul Revere, who rode the countryside to warn of the impending British arrival. Our first stop will be Lexington for a history lesson and visit to the Battle Green site, where the Minutemen faced the British in the first battle of the American Revolution. On the route of the Redcoats, we will travel to historic Concord to the North Bridge where the "shot heard 'round the world" was fired.

We will also learn about the literary greats of the area. We will tour the lovely Orchard House, where Louisa May Alcott lived and wrote the classic novel *Little Women*, the most widely published children's book in the world. Leisure time will be allotted for shopping and lunch on your own. We will continue our tour by experiencing the tranquillity of Walden Pond, as Thoreau did in 1854, when he wrote the classic novel *Walden*. We will also visit the Old Manse, home of Nathaniel Hawthorne and built in 1770. In the upstairs study, Hawthorne wrote *Mosses from an Old Manse*.

Cost: \$43 (includes professional guide, admissions, transportation).


Old Salem and Marblehead

Wednesday, October 27, 12:15 to 4:15 p.m.

Our first stop will be Marblehead, one of the yachting capitals of the country, with an elegant mixture of history and Old World charm. The narrow cobblestone streets and scenic harbor are a sightseer's delight. We will visit Abbot Hall to view the famous painting "Spirit of '76" and learn of Marblehead's history. Our next destination, Salem, is noted for its maritime tradition and its historical legacy of witch trials. We will complete the day with a tour of the House of Seven Gables, a seventeenth century mansion made famous by writer Nathaniel Hawthorne.

Cost: \$31 (includes professional guide, admissions, transportation).

INFORMAL TOURS

Because Boston is such an exciting city with so much to offer, it is not possible to plan tours to every attraction. We are certain that many of you know of additional places you would like to visit during your stay. One of the nice features about Boston is that the city is very easy to get around on your own. For people interested in viewing Boston with a small group, we have the following informal tours planned. Dates and times suggested below are flexible, but will allow registrants to attend as many other activities as possible. *You are responsible for expenses.* All locations can be reached by the  or a short cab ride. Sign-up sheets will be posted in the Hospitality Room. We will also have blank sign-up sheets for additional tours or alternate times for the suggested tours.

- **Freedom Trail**—Sunday, 1:15 p.m.; Wednesday, 1:00 p.m.; Thursday, 8:30 a.m. This walking tour should not be missed. Plan on a half day.
- **Faneuil Hall Marketplace**—Monday, 9:45 a.m. Over 150 specialty shops, 22 restaurants, and 160 years of history.
- **North End**—Monday, 10:00 a.m. A pleasant walk in Boston's Italian section, followed by lunch on your own at one of the many excellent restaurants.

Jazz Concert

with the

NEW ENGLAND CONSERVATORY JAZZ ENSEMBLE

Saturday, October 23, 7:30 to 10:30 p.m.
Boston Park Plaza Hotel

7:30 p.m.—Dessert—Arlington/Berkeley Room
8:15 p.m.—Concert—Georgian Ballroom

Begin the evening with a **coffee and sumptuous dessert buffet** featuring fruit fondue, petits fours, mousses, truffles, and other delicious desserts.

Alternative beverages and cordials will be available on a cash basis.

Following dessert, listen to one of the area's **premier jazz** ensembles. Social hour will follow the concert with a cash bar.

The Park Plaza Hotel is a short walk or taxi ride from all downtown hotels. Transportation will not be provided.

Tickets: \$12

(includes coffee and dessert buffet, concert)

Begin the week right!

Plan now and register early for this enjoyable evening.
Preregistration only.

Boston Symphony Orchestra and Dinner

**SATURDAY, OCTOBER 23
6:00 TO 10:30 P.M.
SYMPHONY HALL**



A very special evening with Seiji Ozawa conducting the Boston Symphony Orchestra.

The Tanglewood Festival Chorus will perform the *Berlioz Requiem*, with Vinson Cole, tenor.

Dinner at the Chop House Restaurant, next door to historic Symphony Hall will precede the performance.

Although GSA is handling the registration for this on the GSA registration form, this special event has been organized by Nancy Morris Adams of Travel to Music. You will receive further information, including a map and tickets, from Nancy after you register. Transportation will not be provided; however Symphony Hall is only a short walk or cab ride from the hotels.

This will be a very popular performance with Boston music lovers, so sign up early. Seats will be assigned in the order received. **Available through preregistration only.**

Cost: \$65. Limit 50.



- **New England Aquarium**—Monday, 1:00 p.m. Featuring more than 2000 aquatic creatures in a four-story glass ocean tank with a coral reef, sharks, and sea turtles.
- **Christian Science Center**—Tuesday, 9:30 a.m. Visit the Mapparium, which is a 30-foot-diameter stained glass globe of Earth, where you are in the center.
- **Harvard Square**—Tuesday, 1:00 p.m. More than 40 bookstores to browse through.
- **Filene's Basement**—Tuesday, 1:00 p.m. Founded in 1908, it's the country's oldest bargain store. Famous brands incredibly marked down.
- **Museum of Science**—Wednesday, 9:15 a.m. A fascinating look at science, with more than 400 interactive, participatory exhibits.
- **Museum of Fine Arts**—Wednesday, 12:30 p.m. A collection of some of the world's finest art. You won't want to miss the special exhibition of paintings by Peter Paul Rubens.
- **Brewery Tour**—Thursday, 1:45 p.m. Visit the home of Samuel Adams Lager.

SEMINARS

All GSA meeting attendees—guest, professional, and student registrants—are invited to attend the following seminars. There is no fee. All seminars will be at the Marriott Hotel. Stop by the Hospitality Room to find the exact room location.

Welcome to Boston

Monday, October 25, 8:15 to 9:00 a.m.

During this orientation, learn something of the history of Boston, the "Athens of America." A city of history and site of cultural and architectural splendor, Boston has been the center stage of change and progress in America for three and a half centuries. Join us for an overview and learn about the exciting tours and seminars we have planned for you.

Thriving on Uncertainty and Rapid Change

Monday, October 25, 1:15 to 3:30 p.m.

Develop confidence in dealing with life's surprises. The stress created by uncertainty and rapid change can dominate our personal and professional lives. You can learn to *thrive* on change, rather than just coping with it. Michael Connolly, well-known educator, will share new strategies for mastering change. This fascinating topic touches every one of us daily. Don't miss this highly recommended seminar, as Connolly entertains us with information guaranteed to **change** your outlook.

History of Boston's Neighborhoods

Tuesday, October 26, 9:00 to 11:15 a.m.

Professor Andrew Buni of Boston College will present an overview of the history of Boston's unique neighborhoods from post-World War I to the present. After the seminar we will go on a walking tour to nearby Copley Square, Trinity Church, Boston Public Library, and the Public Gardens (see Formal Tours).

Peace Through Music

Wednesday, October 27, 9:00 to 10:30 a.m.

Join us for a thoroughly enjoyable session of relaxing and soothing music. Ann Williams from WMJX radio station in Boston will entertain us to the strains of New Age music. Her insights into how music can be used to create harmony in our lives and to be a de-stresser will enlighten and inform you. This is a special seminar not to be missed. Give your soul the gift of an emotional massage!

Special Events

Welcoming Party

Sunday, October 24, 5:00 to 9:00 p.m.; Hynes Convention Center.

Come and join your colleagues Sunday evening for the celebration and grand opening of the exhibit hall that kicks off the 1993 GSA Annual Meeting! This is the time to meet with new and old friends to plan the next four days of meeting activities. Relax and enjoy the various musicians throughout the exhibit hall while viewing the exhibits, eating, and enjoying your favorite beverage. You will be surprised by the new activities we have in store for you!

GSA Presidential Address and Awards Ceremony

Monday, October 25, 5:30 to 7:30 p.m.; Hynes Convention Center.

The GSA Presidential Address and Awards Ceremonies will begin with President Robert D. Hatcher's address, *Geosciences—Will Our Training and Traditions that Brought Us Here Be Enough to Carry Us to Where We Want to Go?* The GSA Awards Ceremony will follow immediately.

Penrose Medal Alfred G. Fischer

Arthur L. Day Medal Hugh P. Taylor, Jr.

Young Scientist Award

(Donath Medal) Michael C. Gurnis

GSA Distinguished Service Award ... Michel T. Halbouty

Recognition will also be given to newly elected Honorary Fellows Sir George Malcolm Brown, Kristján Saemundsson, and Victor A. Ramos.

Alumni Receptions

Monday, October 25, 7:00 to 9:30 p.m.; Boston Park Plaza Hotel.

Everyone knows someone at the popular Alumni Receptions. More than 80 colleges and universities will be represented. If you would like your university to hold a reception or to be part of the Group Alumni Party, have your department chair contact Vanessa George, Events Coordinator, GSA headquarters.

Awards Luncheons and Other Ticketed Meal 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. You do not need to be registered for the meeting; everyone is welcome. Please use the Registration Form in this issue to order tickets. Location and time will appear on the ticket.

Geochemical Society Lunch Monday, October 25

National Association of Geology Teachers Lunch ... Monday, October 25

Association for Women Geoscientists Breakfast Tuesday, October 26

Geoscience Education Division Lunch Tuesday, October 26

Geoscience Information Society Lunch Tuesday, October 26

Hydrogeology Division Lunch Tuesday, October 26

Mineralogical Society of America Lunch Tuesday, October 26

Paleontological Society Lunch Tuesday, October 26

Society of Economic Geologists Lunch Tuesday, October 26

Coal Geology Division Lunch Wednesday, October 27

Engineering Geology Division Lunch Wednesday, October 27

History of Geology Division Lunch Wednesday, October 27



It had to happen! Any visit to Boston must include a dinner of lobster and a tour of the harbor area, so call your friends and make a night of it!

Lobster Clambake Dinner Cruise

Wednesday, October 27

6:00 to 7:00 p.m. board, 7:00 to 10:00 p.m. cruise

Narrated cruise of historic Boston Harbor aboard *The Spirit of Boston*

Buffet Dinner includes

New England Lobster 🦞 Barbecued Chicken 🍗 Steamed Shellfish

Corn on the Cob 🌽 Roasted New Potatoes 🍠 Cole Slaw

Choice of Scrumptious Desserts 🍰 Coffee

Cash Bar

Salute to Broadway review performed following dinner by your waiters

Dance to a Live Band featuring top 40s and Oldies

Boarding begins at 6:00 p.m.—Boat departs at 7:00 p.m. **sharp**

Cost: \$48 (includes transportation to and from boat, narrated cruise, dinner, entertainment, dancing).

**Don't
you miss
the boat!**

TRAVEL AND LODGING

Getting To Boston

By Air. Logan International Airport is just two miles outside the city. The airport is served by most major airlines. There is convenient public transportation from the airport to downtown Boston and suburban locations. Logan's 1-800-23-LOGAN ground transportation hot line provides round-the-clock schedule information on transportation alternatives to and from Logan.

GSA's official travel agent, Cain Travel Group, has negotiated discounted rates with the major Boston carriers. Cain can also assist you with the special discounts and coupon offerings in your area. Call today for the best availability.


To make a reservation, call Cain Travel and identify yourself as a GSA traveler. Tickets can be paid for by check (payable to Cain Travel), or by major credit card, or invoiced to your company. Final payment must reach Cain Travel no later than 10 days prior to departure to allow for mailing time. All tickets will be mailed via certified mail upon receipt of payment unless requested otherwise. After tickets are issued, you are protected from fare *increases*; if a fare *decreases*, call Cain Travel for adjustment.

As with all airline reservations, please use caution regarding change and cancellation penalties that accompany low-fare tickets. This *especially* applies to field trip participants whose trips may be canceled after the September 24 preregistration deadline. Be sure you understand the restrictions on the type of ticket you purchase.

Cain Travel will have an on-site Customer Service Desk at the Hynes Convention Center during the meeting.

Students: The GSA Foundation has awarded matching grants to each of the six GSA sections to assist students wishing to travel to GSA section and annual meetings. For applications, contact individual section secretaries, or call GSA headquarters.


By car. Getting into Boston: from the west, Route 90 (Massachusetts Pike) is the clearest route inbound; from the south, Routes 95, 24, and 3 all feed into Route 128 east, which leads into Route 9 inbound; from the north, use Routes 95, 1, and 93. Driving in Boston can be a confusing experience, however. Heavy traffic, narrow and unexpected one-way streets, and the high cost of parking are just a few of the surprises. If driving is necessary, it is helpful to check a detailed Boston street map before setting out.

By bus, train, and subway. The Greyhound Bus terminal is located downtown at 10 St. James Street, Boston, (617) 423-5810. This is near the Arlington Street MBTA  subway stop across from the Boston Park Plaza Hotel. AMTRAK serves Boston, New York, and Washington, and is also nationwide. Back Bay is the most convenient arrival station because it is within three blocks of the Hynes Convention Center, the Marriott Copley Place, and other GSA hotels. For AMTRAK information, call (617) 482-3660 or 1-800-392-6099. The MBTA Subway Commuter Rail extends from downtown Boston to as far as 60 miles away. It is a popular

and convenient way to get around Boston. Commuters become familiar with the system easily, and it is generally the best way to get from the hotels to the convention center. Discounted MBTA passes will be sold on site. For MBTA information call (617) 722-3200.

Getting To Your Hotel

Logan International Airport is approximately 6 miles from the Hynes Convention Center downtown. Ground transportation to and from the airport can be quite hectic; however, there are several modes of transportation that can ease your trip.


T Subway and airport shuttle buses. The  (Massachusetts Bay Transportation Authority) runs from Airport Station at Logan International Airport to the Hynes Convention Center. Free shuttle buses provide service from your airline terminal to Airport Station. Once at Airport Station board the *in-bound Blue* Line train to Government Center. At Government Center change to the *in-bound Green* Line and take the B, C, or D train to the Hynes/Auditorium/ ICA station. Service operates from 5:00 a.m. to 1:00 a.m. One-way cost is \$0.85.

Airways transportation. This service operates from 7:00 a.m. to 8:00 p.m. daily. Buses depart from outside the baggage claim level every hour. Look for the red and gray mini-buses. Tickets can be purchased from the bus driver. Airways Transportation picks up from all major downtown hotels. Your hotel bell captain has information about pick-up and departure times. No reservation is necessary. For information call (617) 442-2700. One-way cost is \$8.50.

Taxicabs. Several taxicab companies serve the city of Boston. Taxicab service to and from the airport and within the city is easy to obtain and a convenient way to travel. Taxicab stands are located throughout the city, or you can hail a cab on the major streets. Taxicabs cost a minimum of \$1.50 and \$0.20 for each 1/7 mile thereafter, plus all toll fees and an additional \$1 for cabs originating at Logan International Airport. Approximate cost from the airport to downtown is \$18 to \$21.

Car rental. Alamo is the official car rental agency for the meeting. Identify yourself as a GSA delegate by giving Group ID number 85204 and Plan Code GR to get guaranteed, discounted, daily/weekly rates as follows: economy \$33/\$139; compact \$35/\$149; intermediate \$37/\$159; standard \$39/\$179; premium \$45/\$199; luxury \$49/\$239. An additional convention discount may be available by having your Alamo agent check Rate Code 7G. Rates include unlimited mileage. An Alamo rental counter is located on the baggage claim level in each terminal at Logan International Airport. Look for the blue and yellow Alamo vans. Advance reservations are recommended. Call Alamo at 1-800-732-3232.

Getting Around in Boston

Boston is definitely a city for walking. Take advantage of the reliable and efficient  system throughout the city. Traffic can be very slow, and finding a parking space for a car can be difficult.

GSA will not be providing a daily shuttle for registrants. It is easy to get around downtown on foot, but you should plan for up to a 20 minute walk from some downtown hotels to the Hynes Convention Center. Refer to the hotel descriptions and the map for exact distances. There is a covered walkway from the Marriott Hotel to the Hynes Convention Center. This walkway can be entered at various points if you are walking from other downtown hotels.

Lodging

Boston is a wonderful city offering the best in convention facilities and a variety of hotel options. With the spectacular fall foliage, October is Boston's peak time of year for visitors. GSA has arranged special rates at eleven hotels near the Hynes Convention Center and four hotels available by public transportation. They have been selected to suit a variety of tastes and budgets. All meet GSA's standards for rate reliability, cleanliness, service, and location.

Meeting activities will take place in the historic Back Bay section of Boston, which is the location of the Hynes Convention Center as well as of GSA's headquarters hotel, the **Boston Marriott Copley Place**, and the

Win a FREE TRIP



Make your Boston reservations through **Cain Travel Group** and become eligible to win one round-trip ticket on United Airlines anywhere within the contiguous United States. The drawing will be held November 15, 1993. **Cain Travel Group**, GSA's official travel agent, guarantees the lowest possible fares for the Boston Annual Meeting. For discounts, convenience, and fast service, call:

1-800-346-4747 TOLL FREE
(303) 443-2246 collect from outside the U.S.
fax 303-443-4485

8:30 a.m.–5:30 p.m. MST, Monday–Friday
If airfares drop, Cain will automatically reissue
your ticket at the lower rate!

Call CAIN TRAVEL GROUP Today

Boston Park Plaza Hotel. The Marriott is a first-class property connected to the Convention Center by enclosed walkways. It is also connected to the Copley Place Shopping Galleries, with more than 100 fine shops. Back Bay is one of Boston's oldest and most upscale areas. Scores of cultural and historic landmarks, art galleries, theaters, fine shops, and restaurants are within easy walking distance.

The key to getting your first choice is to make your reservation **early**. Because October is Boston's busiest month, we strongly recommend that GSA meeting attendees get their reservations in **as early as possible**. Convention hotels will fill quickly.

TO MAKE YOUR HOTEL RESERVATION

Fill out the Official Housing Request Form and mail or fax it to the Boston's GSA Housing Bureau at the address shown on the form. Reservations will not be accepted by phone. All reservations must be RECEIVED BY FRIDAY, SEPTEMBER 24. From the September 24 deadline until October 1, the Housing Bureau will continue to accept reservations by mail or fax, *but rooms will be on a space-available basis only*. Most properties will be full at this time; therefore it is important that you make your reservation early. The Housing Bureau will continue to process reservations until October 1.

AFTER Friday, October 1, you should contact the GSA hotel of your choice directly, or you may contact the Housing Bureau for information on hotel availability at (617) 536-9028. Note that most hotels **will be filled** by September 24, and hotels will be able to offer the special GSA rate only on a space-available basis. *Under no circumstances should they be offering rooms to GSA registrants at a higher rate.*

If you are interested in a suite, please call the hotel of your choice for information. The Housing Bureau will NOT be handling suite reservations.

ASSIGNMENT

Hotel rooms will be assigned on a first-come, first-served basis as requests are received by the Housing Bureau. Please list your first six hotel choices in order of your preference. If the hotels you have chosen are sold out, the Housing Bureau will review your selection preference on the Housing Form. Be sure to mark either (1) proximity to convention center or (2) comparable room rate. You will receive an acknowledgment from the Housing Bureau with your hotel assignment. Check all information carefully for accuracy, including arrival date, departure date, and guarantee information. If you do not receive an acknowledgment within two weeks, contact the Housing Bureau to check the status of your reservation.

Within two weeks from the time you receive the Housing Bureau acknowledgment, you should receive a confirmation from your hotel. This is notice that the hotel has received your reservation from the Housing Bureau and that the reservation has been entered into their system. Please check the confirmation carefully.

ROOM DEPOSITS AND GUARANTEES

Reservations must be guaranteed. A first night's room deposit will guarantee your reservation, assuring you that no matter what time you arrive on your scheduled arrival day, your room will be held until 6:00 a.m. the following morning.

Deposits can be made by (1) providing credit card information on the Housing Form, or (2) sending payment directly to the hotel once you have received your confirmation. The deposit amount should be the cost of one night's stay plus 9.7% tax at your assigned hotel. Note that the Housing Bureau will accept ONLY credit cards; **not** checks or cash. Checks and cash received will be returned to you. When making payment directly to the hotel, be sure to give your confirmed reservation number.

CHANGES AND CANCELLATIONS

Changes and cancellations BEFORE Friday, October 1, should be communicated to the Housing Bureau by phone (617) 536-9028 or fax 617-536-0813. Call the Housing Bureau for all last-minute inquiries, cancellations, changes, or problems. Their hours are 8:30 a.m. to 5:00 p.m. Eastern time, Monday through Friday.

AFTER October 1, you should contact the hotel directly with any changes. Please note that a cancellation notice must be received by the hotel AT LEAST 48 hours in advance to receive a refund on your first night's room deposit. The hotel has the right to bill you for one night's housing if you fail to properly cancel a guaranteed reservation. Please show courtesy as a professional by notifying the hotel if your plans change.

Please don't be a No Show. If you must make changes, please call the hotel at least 48 hours before your scheduled arrival. This consideration helps us all.

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. After inspecting all GSA properties, we recommend that disabled registrants consider staying at the Back Bay Hilton, Marriott Copley Place, or Westin Hotel. There will be no shuttle service between hotels and the Hynes Convention Center. However, the Hilton is directly across the street from the Hynes, and the Marriott and Westin are accessible via an indoor skywalk. If you have questions, please contact Becky Martin, GSA headquarters.

STUDENT HOUSING

Outside of the Back Bay area, reasonably priced rooms have been reserved at four properties. Public transportation to the Hynes Convention Center is convenient. Take the Green Line (T), Hynes/ICA Station. **Make your reservation for the Holiday Inn and Howard Johnson with the Boston Housing Bureau on the Housing Request Form. For the Days Inn and the YMCA, call the hotel direct and identify yourself as a GSA Meeting attendee.**

Holiday Inn Boston Brookline \$80 (1-4 people) 75 rooms blocked
1200 Beacon Street, Brookline, MA 02146, (617) 277-1200
Free Parking, full-service restaurant, indoor pool, 3/4 baths (no full tubs).
Transportation: Use the Green Line (T), C Train, Brookline Station (\$0.85 each way, approximately 20 minutes).

Howard Johnson Hotel \$95 (1-4 people) 75 rooms blocked
575 Commonwealth Avenue, Boston, MA 02215, (617) 267-3100
On Boston University campus, free parking, full-service restaurant (20% discount in hotel restaurants by showing your student ID).
Transportation: Use the Green Line (T), Kenmore Square Station (\$0.85 each way, approximately 10 minutes).

Days Inn Boston/Newton \$65 (1-4 people) 50 rooms blocked
399 Grove Street, Newton, MA 02162, (617) 969-5300 (general), (617) 969-1828 (to make your reservation).
The \$65 rate includes up to two complimentary full breakfasts per room. Free parking, full-service restaurant.
Transportation: Use the Green Line (T), D Train, Riverside Station (\$2 into the city, \$0.85 out of the city, approximately 45 minutes).

YMCA, Central Branch \$33 single, \$48 double
316 Huntington Avenue, Boston, MA 02115, (617) 536-7800
Rate includes full breakfast, athletic facilities, common bathroom facilities.
Transportation: Use the Green Line (T), Northeastern University Station (\$0.85 each way, approximately 10 minutes).

ALTERNATIVE LODGING

Boston is an expensive city, but beating the high cost of lodging is still a priority of the GSA staff and the 1993 Annual Meeting Committee.

- Consider properties outside the Back Bay area. Public transportation by subway and bus is available. The rates typically range from \$65 to \$95 per night for a single room in October.
- Check your library copy of the *Hotel and Motel Redbook*, which lists metro properties. Because of the hundreds of properties in the area, GSA cannot provide a complete list.
- Call 1-800-555-1212 or check the Yellow Pages to learn the 800 number for your favorite hotel chains, such as Super 8 Motel or Comfort Inn, which have properties outside the downtown area. You will need to provide your own transportation or use Boston public transportation.

GSA CONVENTION HOTEL RATES

	Single	Double	Triple	Quad
1 Boston Marriott Copley Place (headquarters)	\$145	\$165	\$185	\$205
2 Boston Park Plaza Hotel	\$119	\$130	\$150	\$170
3 57 Park Plaza Hotel	\$ 99	\$ 99	\$ 99	\$ 99
4 Tremont House	\$105	\$120	None	None
5 Back Bay Hilton	\$125	\$145	\$165	\$185
6 MidTown Hotel	\$ 89	\$ 99	\$109	\$119
7 The Colonnade	\$138	\$138	\$153	\$168
8 Westin Hotel, Copley Place	\$160	\$160	\$180	\$200
9 Copley Square Hotel	\$ 95	\$105	\$115	\$125
10 Lenox Hotel	\$135	\$155	\$175	\$195
11 John Hancock Conf. Center	\$ 80	\$ 90	None	None

Student Housing

Holiday Inn Boston Brookline	\$ 80	\$ 80	\$ 80	\$ 80
Howard Johnson Hotel	\$ 95	\$ 95	\$ 95	\$ 95
Days Inn Boston/Newton*	\$ 65	\$ 65	\$ 65	\$ 65
YMCA, Central Branch*	\$ 33	\$ 48	None	None

*Call hotel direct

GSA 1993 Convention Hotels

Please make your reservation with the Boston Housing Bureau.
Note: All rooms are subject to a 9.7% occupancy tax.

1 Boston Marriott Copley Place (Headquarters)

110 Huntington Avenue, Boston, MA 02116
(617) 236-5800 (600-room block)
3 blocks from the Convention Center, 10-minute walk

Across from the famous Copley Square in the Back Bay Section of Boston, the Marriott offers 38 floors of elegance. You can expect excellent Marriott service, convenience, and comfort. Guests can dine in three restaurants, enjoy leisurely cocktails in The Terrace Lounge or the Sushi Bar, or share in the excitement at the sports bar. A fully equipped health club with indoor pool, whirlpool, sauna, and massage therapy is available. Self and valet parking are available for \$17 and \$20 respectively per night. An enclosed walkway takes you conveniently and quickly to the Hynes Convention Center. The hotel is also connected to Copley Place Shopping Galleries, an upscale complex with more than 100 fine shops, restaurants, and entertainment options.

Check-in: 4:00 p.m. Check-out: 12:00 noon
CC: AX, CB, MC, V

2 Boston Park Plaza Hotel

64 Arlington Street, Boston, MA 02116
(617) 426-2000 (500-room block)
9 blocks from the Convention Center, 25-minute walk

Overlooking the picturesque Public Gardens, the Park Plaza Hotel recalls the grand hotels of yesteryear. Built in 1927, the hotel offers elegant four-star dining to casual dining in the charming Cafe Rouge. And don't miss Legal Sea Foods, a Boston institution. Relax in one of the hotel's three lounges. The Swan Lobby Lounge is the ideal spot for afternoon tea. Fitness devotees can take advantage of the hotel's complimentary Fitness Club. Valet parking is \$14 per day with in and out privileges.

Check-in: 3:00 p.m. Check-out: 12:00 noon
CC: AX, D, DC, ER, MC, V

3 57 Park Plaza Hotel

200 Stuart Street, Boston, MA 02116
(617) 457-2632 (100-room block)

10 blocks from the Convention Center, 20-minute walk

The 24-story 57 Park Plaza Hotel is located just a short stroll from shopping, theater, art, culture, movies, and the financial district. The hotel offers on-premises complimentary under-cover parking, free Showtime movies, heated indoor pool, and sauna. The 57 Restaurant is a favorite dining spot for local theater-goers, while the Plaza Cafe offers casual dining for breakfast, lunch, and dinner, opening at 6:30 a.m. daily.

Check-in: 3:00 p.m. Check-out: 12:00 noon
CC: AX, DC, MC, V

4 Tremont House

275 Tremont Street, Boston, MA 02116
(617) 426-1400 (60-room block)

11 blocks from the Convention Center, 25-minute walk

One of Boston's landmarks of the Jazz Age, the handsomely restored Tremont House captures the style and flavor of the city and puts you at the center of the Hub's most appealing attractions and neighborhoods. It is located in the heart of the theater district, and the Boston Common, historic center of the city. Built in 1925, the hotel has retained its flare for entertainment, featuring two dance clubs and the legendary NY Stage Deli. The Deli serves breakfast, lunch, and dinner.

Check-in: 3:00 p.m. Check-out: 12:00 noon
CC: AX, CB, D, DC, ER, MC, V

5 Back Bay Hilton

40 Dalton Street, Boston, MA 02115
(617) 236-1100 (250-room block)

1 block from the Convention Center, 5-minute walk

Just minutes from the Hynes Convention Center, the Back Bay Hilton offers spacious, soundproof rooms with sweeping views of the surrounding city. With only 16 rooms per floor, you are assured of maximum privacy. Boodles, the hotel's restaurant, is an award-winning authentic grill, serving breakfast, lunch, and dinner. Boodles Bar offers the area's widest selection of American specialty beers. Amenities include a year-round pool, warm-weather sun deck, and fitness center.

Check-in: 3:00 p.m. Check-out: 12:00 noon
CC: AX, CB, D, DC, ER, MC, V

GSA Annual Meeting, October 25-28, Housing Request Form

Your Housing Request Form must be received BY FRIDAY, SEPTEMBER 24. Please read all hotel information prior to filling out this form. Use one form per room. Make additional copies if needed. Be sure to keep a copy for your records. Please print or type and either:

- 1) **Mail to:** GSA Housing Bureau OR 2) **Fax to:** 1-617-536-0813 (do not fax *and* mail)
Prudential Tower, Suite 400
P.O. Box 490
Boston, MA 02199

For changes, cancellations, and inquiries call the Boston Housing Bureau at (617) 536-9028.

TYPE OF ACCOMMODATION NEEDED:

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

Departure Date _____ Time _____ a.m./p.m.

- Single (1 person, 1 bed) Triple
 Double (2 persons, 1 bed) Quad
 Double/Double (2 persons, 2 beds) Add rollaway

Rate requested \$ _____ (NOTE: All rooms are subject to 9.7% tax)

(For suites, call the hotel)

- Non-Smoking Room Requested
 Special Room Requirement _____

MAIL CONFIRMATION TO:

Name _____

Address _____

City _____

State _____ ZIP _____ Country _____

Telephone (_____) _____

NAMES OF ALL ROOM OCCUPANTS:

1. _____ 3. _____

2. _____ 4. _____

HOTEL PREFERENCE BY NAME:

1. _____ 4. _____

2. _____ 5. _____

3. _____ 6. _____

If all six requested hotels are unavailable, please process this reservation according to: Comparable Room Rate
 Proximity to Convention Center

GUARANTEED ROOM RESERVATION AUTHORIZATION:

All GSA hotels require reservations to be guaranteed. I understand that the hotel may bill me for one night's housing if I fail to properly cancel a guaranteed reservation. Please check one:

- Credit card information is provided below to guarantee my reservation. (Do not send checks or cash to the Housing Bureau.)
 My guarantee will be made directly to the hotel after I receive my hotel confirmation.

Please guarantee my room reservation with the following:

American Express MasterCard VISA Other _____

Name (as listed on credit card) _____

Signature _____

Card Number _____

Exp. Date _____

*** DO NOT SEND CHECKS OR CASH WITH THIS FORM ***

6 MidTown Hotel
 220 Huntington Avenue, Boston, MA 02115
 (617) 262-1000 (100-room block)
 4 blocks from the Convention Center, 10-minute walk

For the traveler on a budget, this hotel offers a blend of economy and comfort. This property has pleasant, spacious rooms with free parking for hotel guests. The hotel has one restaurant that serves breakfast, lunch, and dinner at reasonable prices beginning at 6:30 a.m. daily.

Check-in: 1:00 p.m. Check-out: 12:00 noon
 CC: AX, CB, D, DC, MC, V

7 The Colonnade
 120 Huntington Avenue, Boston, MA 02116
 (617) 424-7000 (50-room block)
 2 blocks from the Convention Center, 5-minute walk

The Colonnade caters to those who like the intimacy and comfortable elegance of a contemporary European-style hotel. Amenities include on-site parking for \$17 per day, fitness room, casual and fine-dining restaurants, jazz lounge, and a rubber duck for your tub.

Check-in: 3:00 p.m. Check-out: 12:00 noon
 CC: AX, D, MC, V

8 Westin Hotel, Copley Place
 10 Huntington Avenue, Boston, MA 02116
 (617) 262-9600 (50-room block)
 4 blocks from the Convention Center, 10-minute walk

The excellence and quality of the Westin name holds true at this lovely 36-story property. One of Westin's three restaurants is award-winning Turner Fisheries, well known for their excellent clam chowder. The hotel also features a casual European-style restaurant for breakfast, lunch, and dinner. Live classical piano music echoes through the busy atrium lobby and lounge, which connects the hotel to Copley Place, a shopper's heaven. Enjoy the indoor pool, jacuzzi, and health club after a full day. The Westin is connected to the Hynes Convention Center by the skywalk.

Check-in: 3:00 p.m. Check-out: 1:00 p.m.
 CC: AX, CB, DC, D, ER, MC, V

9 Copley Square Hotel
 47 Huntington Avenue, Boston, MA 02116
 (617) 536-9000 (90-room block)
 3 blocks from the Convention Center, 10-minute walk

Built in 1891, this recently renovated small property has an excellent location and offers a warm European atmosphere. Having all the comforts of home, such as in-room coffee makers, the hotel offers excellent dining options. Pops' Place has the ambiance of an outdoor cafe. After visiting the hotel's well-known Original Sports Saloon, you may want to try the Cafe Budapest, specializing in gourmet Hungarian cuisine. There is adjacent indoor parking for \$12 daily, plus in and out fees.

Check-in: 3:00 p.m. Check-out: 12:00 noon
 CC: AX, D, DC, ER, MC, V

10 Lenox Hotel
 710 Boylston Street, Boston, MA 02116
 (617) 536-5300 (100-room block)
 2 blocks from the Convention Center, 10-minute walk

Built in 1900, the Lenox prides itself on keeping its inn-like atmosphere with working fireplaces, high ceilings, and eclectic decor. This small hotel was recently featured in *Country Inns and Back Roads*. Although an older property, the Lenox has been completely renovated and has all the modern conveniences. The Lenox boasts a cozy pub, grill restaurant, and sing-along piano bar—Diamond Jim's—voted Boston's best in 1991 and 1992.

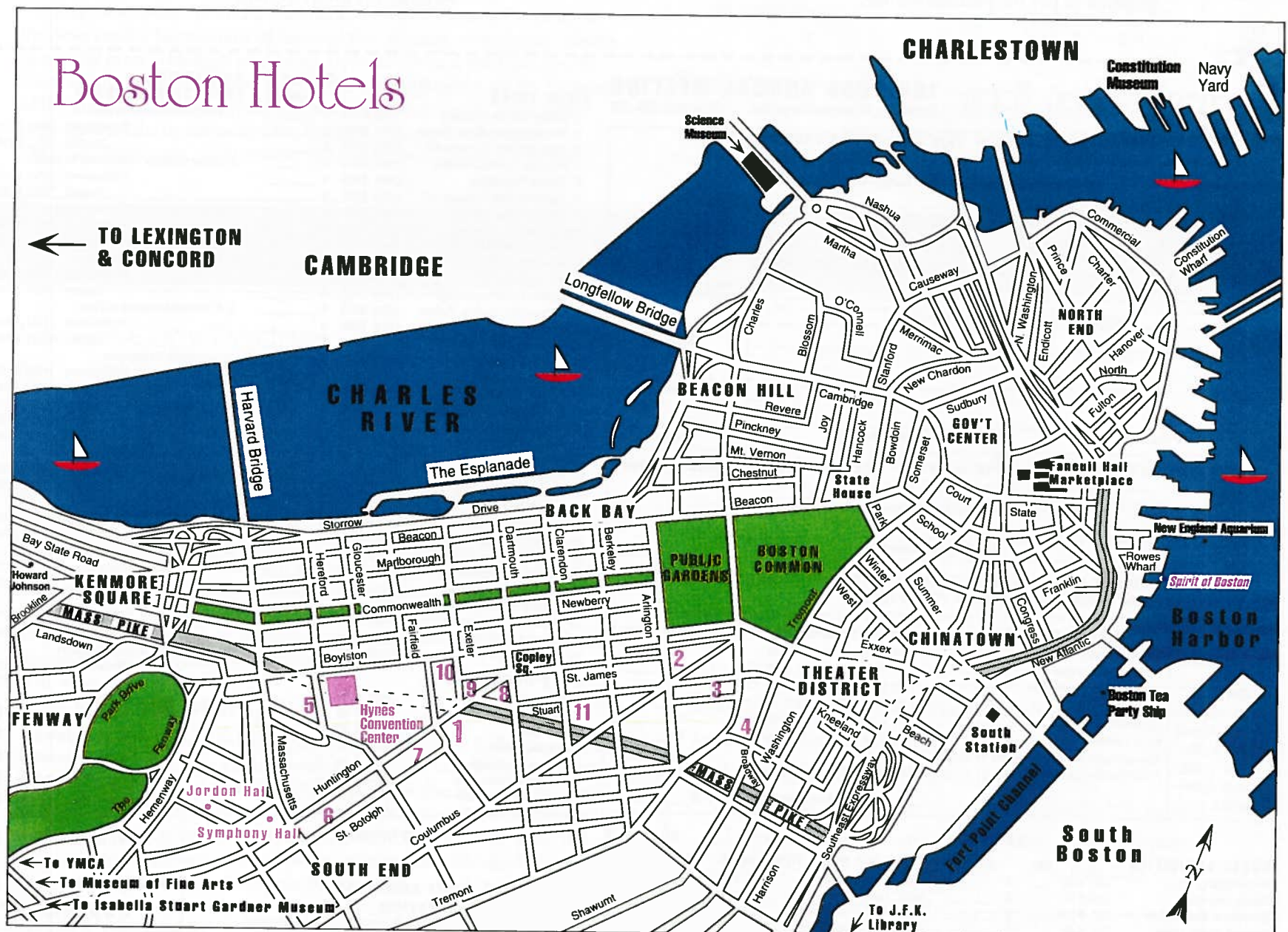
Check-in: 3:00 p.m. Check-out: 12:00 noon
 CC: AX, CB, D, DC, MC, V

11 John Hancock Conference Center
 40 Trinity Place, Boston, MA 02116
 (617) 572-7700 (40-room block)
 5 blocks from the Convention Center, 15-minute walk

This basic, clean facility may make the GSA Annual Meeting more affordable for some. Rooms are comfortable and have one queen size bed, cable television, and a separate bath. Privately owned, this conference center is busy with outside meetings and events. There are no restaurants in the center, but plenty of options in the area.

Check-in: 2:00 p.m. Check-out: 12:30 p.m.
 CC: MC, V

Credit Card (CC) Codes: AX = American Express, CB = Carte Blanche, D = Discover, DC = Diners Club, ER = En Route, MC = MasterCard, V = VISA.



Adapted from map of Boston ©1988 by Addison-Wesley Publishing Company, reprinted with permission. From the book *Discovering Boston: A Guide to Hidden Spaces and Special Places* ©1990 by Addison-Wesley Publishing Company.

- 1 Boston Marriott Copley Place (headquarters) 2 Boston Park Plaza Hotel 3 57 Park Plaza Hotel 4 Tremont House
 5 Back Bay Hilton 6 MidTown Hotel 7 The Colonnade 8 Westin Hotel, Copley Place
 9 Copley Square Hotel 10 Lenox Hotel 11 John Hancock Conference Center

REGISTRATION

Preregister Today!

Preregistration Deadline:
Must be received no later than September 24

1. There is a \$15-\$30 savings in fees if you register before the preregistration deadline! Advance registration is suggested for many of the special activities because of participation limits. Use the preregistration form provided in this announcement.
2. Badges must be worn for access to ALL activities, 10:00 a.m. Sunday through 5:00 p.m. Thursday.
3. Registration discounts are given to both GSA and Associated Society members. Associated Societies that qualify for this discount are indicated on the registration form. Please indicate your affiliation(s) to register using the member rates. Nonmembers who become GSA members by October 15, 1993, can register at the member rate.
4. Full payment MUST accompany registration. Unpaid purchase orders are NOT accepted as valid registration. Charge cards are accepted as indicated on the preregistration form. If using a charge card, please recheck the card number given—errors will delay your registration. The confirmation card will be your receipt for charge card payments. No other receipt will be sent.
5. Register one professional or student per form. Copy the form for your records.
6. Guest registration is required for those attending guest activities, technical sessions, or the exhibit hall. Guest registrants MUST be accompanied by either a registered professional or student. A guest is defined as a nongeologist spouse or friend of a professional or student registrant.
7. Students must show a CURRENT student ID in order to obtain student rates. Students not having a current student ID when either registering on-site or picking up badges at the preregistration counter will be required to pay the professional fee.

8. Because of a new registration process, it is imperative that ALL preregistrations are RECEIVED by the preregistration deadline of September 24. All registrations received after September 24 will be held for on-site processing.

CANCELLATIONS, CHANGES, AND REFUNDS

All requests for registration additions, changes, and cancellations must be made in writing and received by October 1. GSA will refund preregistration fees for cancellations received in writing by October 1. 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 and ticket sales.

REGISTRATION FEES

	Full Meeting		One-Day
	Advance	On-Site	
	(by Sept. 24)		
Professional—Member	\$165	\$195	\$ 98
Professional—Nonmember	\$205	\$235	\$118
Student—Member	\$ 65	\$ 80	\$ 40
Student—Nonmember	\$ 85	\$100	\$ 50
Guest or Spouse	\$ 75	\$ 90	Not Available
K-12 Teachers	\$ 15	\$ 25	Not Available
Short Course or Field Trip Only	\$ 25	\$ 25	Not Available

ON-SITE REGISTRATION SCHEDULE

Hynes Convention Center

* Friday, October 22	12:00 noon to 4:00 p.m.
Saturday, October 23	12:00 noon to 4:00 p.m.
Sunday, October 24	9:00 a.m. to 6:00 p.m.
Monday, October 25	7:30 a.m. to 5:00 p.m.
Tuesday, October 26	7:30 a.m. to 5:00 p.m.
Wednesday, October 27	7:30 a.m. to 5:00 p.m.
Thursday, October 28	7:30 a.m. to 11:00 a.m.

* PREREGISTRANTS ONLY!



Preregistration Form 1993 GSA ANNUAL MEETING

Boston, Massachusetts • October 25-28

Please print clearly • THIS AREA IS FOR YOUR BADGE

Name as it should appear on your badge—last name first _____

Employer/University Affiliation _____

City _____ State or Country _____

Mailing Address (use two lines if necessary) _____

City _____ State _____

ZIP Code _____ Country (if other than USA) _____

Phone numbers: (include area code)

Business _____

fax _____

Home _____

GUEST INFORMATION • Please print clearly • This area is for your guest's badge

Name as it should appear on badge—last name first _____

City/State or Country _____

Please inform us in advance of special considerations that you or your guest require.
 I will need special considerations. Please call me.

Circle member affiliations (for registration discount)	PREREGISTRATION FEES (Registration required for participation in all meeting activities.)			
	Fall 4 Days		or 1 Day	
a) GSA b) CF	Professional Member	(1) \$165	(2) \$ 98	Qty. Amount
c) GS d) GIS	Professional Non-Member	(3) \$205	(4) \$118	Qty. Amount
e) MSA f) NAGT	Student Member	(5) \$ 65	(6) \$ 40	Qty. Amount
g) PS h) SEG	Student Non-Member	(7) \$ 85	(8) \$ 50	Qty. Amount
i) AWG j) SGE	K-12 Teacher	(42) \$ 15	Same	Qty. Amount
k) AGID l) SVP	Spouse/Guest (fill in name above for badge)	(9) \$ 75	Same	Qty. Amount
m) NESTA	Field Trip/Education Course only	(98) \$ 25	Same	Qty. Amount
Total Registration Fees \$ _____				

FIELD TRIPS

	Column C	Amount
1 Gabbro-Diorite Intrusions	(100)	\$ 290
2 Tectonic/Metamorphic Events	(101)	\$ 365
3 Tectonic/Strat. Transect, MA	(102)	\$ 400
4 Petrologic/Isotopic Studies	(103)	\$ 320
5 Granite Pegmatites	(104)	\$ 300
6 Taconide Zone Transect, VT	(105)	\$ 335
7 Sea-level/Coast/Shore	(106)	\$ 260
8 Lithotectonic Terranes	(107)	\$ 280
9 Glacial Marine Invasion	(108)	\$ 240
10 Adirondack Highlands	(109)	\$ 290
11 Anthracite Fields	(110)	\$ 285
12 Coastal Lithotectonic Belt	(111)	\$ 195
13 Metamorphic Events, Pelites	(112)	\$ 210
14 Migmatites	(113)	\$ 360
15 Ring Dikes & Plutons	(114)	\$ 310
16 Taconian Quebec, VT	(115)	\$ 345
17 Hartford Rift Basin	(116)	\$ 255
18 Plutonic Complexes	(117)	\$ 300
19 Fluid/Chemical Movement	(118)	\$ 195
20 Proterozoic Geology	(119)	\$ 65
21 Archaeological Geology	(120)	\$ 50
22 Pleistocene Geology	(121)	\$ 65
23 Dimension-Stone Quarries	(122)	\$ 80
24 Harbor & Islands Tour	(123)	\$ 15
26 East Point	(125)	\$ 40
27 Active Tunnel Projects	(126)	free
28 Coastal Geologic Hazards	(127)	\$ 295
29 Allegh. & Avalon. Tectonism	(128)	\$ 270
30 Geology/Geomorphology	(129)	\$ 300
31 Highlights/Metamorphic	(130)	\$ 255
32 Building Blocks	(131)	\$ 20
33 Glaciation, Deglaciation	(132)	\$ 160
34 Avalon & Nashoba	(133)	\$ 295
35 Ground-Water Contamination	(134)	\$ 55

K-12 PROGRAMS

Boston Harbor	(302)	\$ 30
Coastal Geology	(303)	\$ 26
Boston Basin	(304)	\$ 35
Downtown Boston	(305)	\$ 10
Cape Cod Landscapes	(306)	\$ 40
Earth Science Workshop	(307)	free
Teaching Earth Sci/Geol	(308)	free
Share-a-Thon Presenter	(309)	free

Total Column C \$ _____

CONTINUING EDUCATION COURSES

	Column D	Amount
1 GIS and the Geosciences		
Professional (150)	\$135	\$ _____
Student (151)	\$115	\$ _____
2 Urban Geology: Foundation for Health		
Professional (152)	\$145	\$ _____
Student (153)	\$125	\$ _____
3 Asia: The Past 500 Million Years		
Professional (154)	\$230	\$ _____
Student (155)	\$210	\$ _____
4 Contaminant Hydrogeology		
Professional (156)	\$270	\$ _____
Student (157)	\$250	\$ _____
5 Fracture Mechanics of Rock		
Professional (158)	\$240	\$ _____
Student (159)	\$220	\$ _____
6 Alternative Pedagogies		
Professional (160)	\$150	\$ _____
Student (161)	\$130	\$ _____
7 Application of Sed. to Hydrogeology		
Professional (162)	\$150	\$ _____
Student (163)	\$130	\$ _____
8 Computer Mapping at Your Desk		
Professional (164)	\$295	\$ _____
Student (165)	\$275	\$ _____
9 Env./Engr. Geology/Land Use		
Professional (166)	\$130	\$ _____
Student (167)	\$110	\$ _____
10 Geochem/Stable Isotopes of Paleosols		
Professional (168)	\$175	\$ _____
Student (169)	\$155	\$ _____
11 Isotope Hydrology		
Professional (170)	\$175	\$ _____
Student (171)	\$155	\$ _____
12 Fractals: Use in Earth Sciences		
Professional (172)	\$290	\$ _____
Student (173)	\$270	\$ _____

Total Column D \$ _____

Total Column C \$ _____

Total Column B \$ _____

Total Column A \$ _____

Registration Fees \$ _____

Total Remittance \$ _____

GUEST ACTIVITIES

	Qty.	Amount
Bird Watching	(20)	\$ 30
Boston Overview	(21)	\$ 20
Beacon Hill Walking Tour	(22)	\$ 26
Newport, Rhode Island	(23)	\$ 48
Newbury St. Walking Tour	(24)	\$ 8
Botanical/Gardner Museums	(25)	\$ 33
Lexington and Concord	(26)	\$ 43
Old Salem and Marblehead	(27)	\$ 31

SPECIAL EVENTS

Boston Symphony and Dinner	(45)	\$ 65
Jazz Concert and Dessert	(46)	\$ 12
Bravo Boston GSA Chorale	(47)	\$ 18
Chorale with Reception	(48)	\$ 28
Lober Clambake Cruise	(56)	\$ 48

Total Column A \$ _____

TICKETED MEAL FUNCTIONS

	Qty.	Amount
Geochemical Soc. Lunch	(60)	\$ 23
NAGT Lunch	(61)	\$ 23
Women Geosci. Breakfast	(62)	\$ 14
Education Division Lunch	(63)	\$ 23
GIS Lunch	(64)	\$ 23
Hydrogeology Division Lunch	(65)	\$ 23
MSA Lunch	(66)	\$ 23
Paleontological Soc. Lunch	(67)	\$ 23
SEG Lunch	(68)	\$ 23
Coal Division Lunch	(69)	\$ 23
Engineering Division Lunch	(70)	\$ 23
History Division Lunch	(71)	\$ 23

Total Column B \$ _____

Remit in U.S. funds payable to:

1993 GSA Annual Meeting
(All registrations must be prepaid. Purchase Orders not accepted.)

Payment by: Check American Express VISA MasterCard

Card Number _____

Signature _____

Expires _____

MAIL TO: GSA ANNUAL MEETING
P.O. BOX 9140
BOULDER, CO 80301-9140

Preregistration must be received by
September 24

FOR OFFICE USE

A _____ V _____ M _____ CK# _____

DR _____ CR _____

Bal. A/R 1233 _____

Ref. A/P 2006 _____


Refund Check # _____

MEMBERSHIP INFORMATION—JOIN GSA NOW AND SAVE!

If you plan to attend this year's Annual Meeting but are not yet a GSA member, now is the time to join. When you do, you'll save \$40 on your meeting registration by paying the member rate—almost exactly the amount you 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 Associate will receive a \$20 discount on their meeting registration. Again, that's like joining GSA for free!

CONVENIENCE INFORMATION

Accessibility for Registrants with Special Needs

 GSA is committed to making the Annual Meeting accessible to all people interested in attending. If you or your guest need any auxiliary aids or services because of a disability, check the appropriate box on the registration form. Someone from GSA will then contact you regarding your specific needs. If you have suggestions or need further information, contact Becky Martin, GSA headquarters. Please let us know your needs well in advance.

Recycling

To assist nationwide recycling programs and take responsible action in protecting our environment, GSA and the Hynes Convention Center will provide areas for paper, cardboard, and aluminum recycling. Please print on recyclable products and watch for locations in the *Annual Meeting Program*.

We will again offer the "build your own registration kit," which allows registrants to choose only the fliers they want, considerably reducing wasted paper.

Information and Messages

Saturday, October 23 through Thursday, October 28; Hynes Convention Center and Marriott Hotel.

GSA information and message desks will be available during the meeting to take messages on your behalf. Watch for telephone numbers in a future *GSA Today*.

News Room

Sunday, October 24 through Thursday, October 28; Hynes Convention Center.

The News Room provides information on many topics for release to the news media. Let us know of material that is noteworthy for the science or general press. The daily newsletter, *Down to Earth*, is published by the News Room, and we welcome suggestions on newsworthy topics. Members of the press may receive a complimentary registration with appropriate press credentials. In advance of the meeting, contact Sandra Rush, (303) 443-8489, c/o Communications Department, GSA headquarters.

Child Care

Due to insurance and legal issues surrounding child care, daycare will not be provided by GSA. However, we want to make it convenient for families to make arrangements. Please call Vanessa George, GSA headquarters, if you are interested in the options provided:

- GSA coordinates a cooperative service in which parents can share responsibilities for their children. Until October 4, GSA will accept names of interested parents. The information will be distributed to everyone who has responded. Participants are responsible for contacting one another.
- Boston has several private child-care agencies. Although GSA cannot endorse these agencies, we are happy to give the names and phone numbers to you.
- GSA will provide a clean, quiet room at the Convention Center for children and parents. It will have basic furnishings (no cribs or playpens).

Computer and Office Center

Sunday, October 24 through Thursday, October 28; Hynes Convention Center.



PCR Computers will provide PCs, laser printers, copiers, fax, and general office supplies. There is no need to lug along your heavy laptop computer! For a minimal fee, this equipment will be available to produce high-quality reports, transparencies, or last-minute fliers. Plan ahead to use PCR's services. For specific requirements or rental rates, contact Kathy Ohmie Lynch, GSA headquarters.

Tourist Information

Greater Boston Visitors Bureau
Prudential Tower, P.O. Box 490
Boston, MA 02199
(617) 536-4100

Massachusetts Office of
Travel and Tourism
100 Cambridge St., 13th Floor
Boston, MA 02202
(617) 727-3201

Weather

Weather in Boston has distinct seasonal variations. Bring warm clothing and an umbrella for this late autumn visit. The average temperature in late October ranges from low 40's to mid-50's (Fahrenheit).

ABSTRACTS WITH PROGRAMS

Advance-Copy Purchase 1993, Volume 25, Number 6

PRICE \$22 NET EACH

If you reside in the U.S., Canada, or Mexico you may take advantage of the advance-copy purchase option of the Annual Meeting *Abstracts with Programs*. Due to the prohibitive airmail costs and delays for overseas mailings, we regret that we cannot make this offer to everyone. Copies will be mailed about three weeks prior to the meeting. Price includes shipment by first-class mail. **No additional discounts may be applied to this offer.**

The volume will also be for sale at the meeting. Please check to make sure that you have not already purchased a copy of this volume on your membership dues statement or through GSA Publication Sales. **No refunds will be given for duplicate orders.**

TO PLACE YOUR ORDER

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 Friday, September 10. By mail or fax**, use the form provided. **By phone**, call toll-free 1-800-472-1988 (outside Colorado), or use our business phone (303) 447-2020 during office hours (8:00 a.m. to 4:30 p.m. MT).

ON-SITE PURCHASE

Copies of *Abstracts with Programs* will be for sale in the registration area of the Hynes Convention Center. Price: \$22 net each. **No additional discounts will apply.**

ADVANCE-COPY PURCHASE ORDER FORM

1993 Abstracts with Programs

Volume 25, Number 6

Return this form by Friday, September 10. This purchase option is only for those residing in U.S., Canada, and Mexico. No refunds given for duplicate orders. Copy form for your records.

SHIP TO: Check here if GSA Member

Name _____

Address _____

City _____ State _____ ZIP _____

Daytime Phone _____

Quantity _____ at \$22 net each (no additional discounts given)

Amount enclosed \$ _____

Method of payment: (prepayment required)

Check or money order enclosed (U.S. funds, U.S. banks)

Credit card (circle one) MC VISA AmEx Diners

Card No. _____ Exp. Date _____

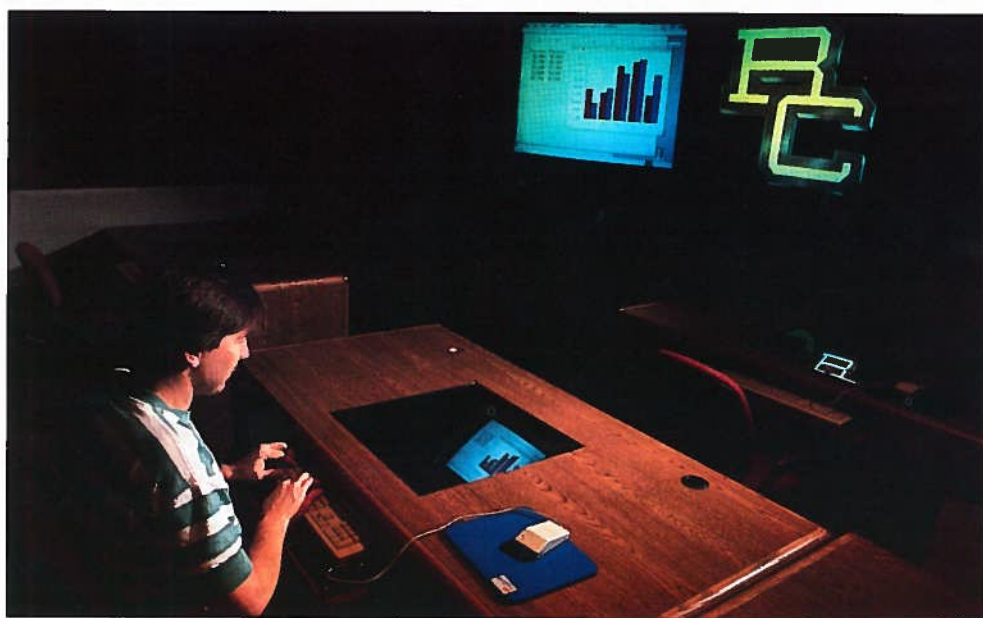
Name of cardholder (print) _____

Signature of cardholder _____

Send to: GSA Publication Sales, P.O. Box 9140, Boulder, CO 80301
1-800-472-1988 • (303) 447-2020 • fax 303-447-1133

Orders must be received by September 10

SCIENCE CLASSROOM OF THE FUTURE



GSA will place special emphasis on various aspects of computer technology in the service of the geological profession, in recognition of the fact that these developments are now and will be progressively of great importance to all geologists. We plan to provide a direct contact among developers, manufacturers, distributors, and geologist users of the technology. We propose to provide a program of demonstrations, some of them featuring hands-on participation by geologists, devoted to a variety of geological disciplines and applications.

The *Science Classroom of the Future* will be located in the Exhibit Hall near a block of booths dedicated to vendors and users of computer hardware and software. We are planning a live display of classroom environments to demonstrate how multimedia technology can be applied to make classroom instruction a more captivating experience. The Computer Technology Committee will feature a program of volunteered and solicited presentations devoted to computer technology:

- 1) In the service of research
- 2) In college and university classroom and laboratory instruction
- 3) In K-12 classroom and laboratory teaching

In the computer technology area of the Exhibit Hall, on Sunday evening and Monday through Wednesday, participants in the *Science Classroom of the Future*, the workshops, and the booths will have the capability of connecting their PC's to Ethernet link, to Internet and to their home system(s) for immediate uploading and demonstration of their instructional and research software. This arrangement is made possible through the courtesy of SynOptics, BBN, MCI, and Boston College.

We have a procedure for geology teachers, researchers, and vendors to submit a mini-proposal for a program, demonstration or workshop, generally in the range of 20 to 40 minutes, for presentation in the *Science Classroom of the Future* or at individual booths. These proposals will be screened and selected so that a balanced program of variety and applicability to the several areas of interest indicated above may be developed. *Please call Matt Ball, GSA headquarters if you are interested, 1-800-472-1988.*

To date the following have indicated that they will participate in some aspect of the computer technology program:

Arlington Public Schools	BBN	Boston College
Cellular One	Continental Cable	Dynamic Graphics
IBM Corporation	MCI	Sci Technologies
SynOptics		

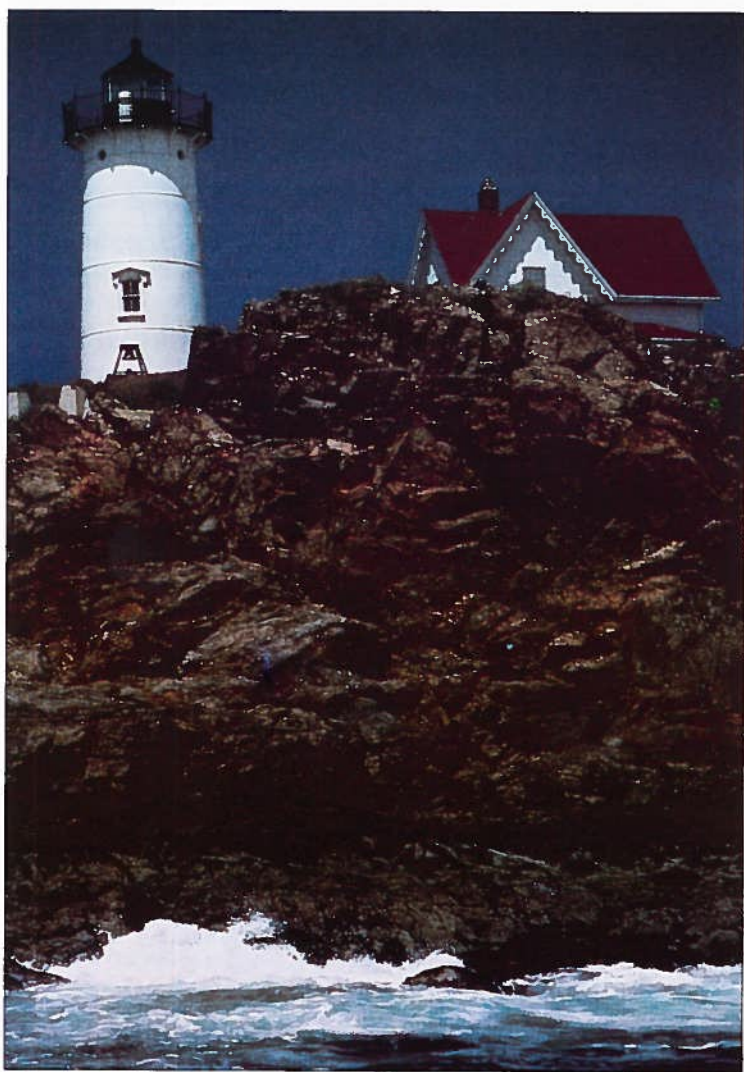
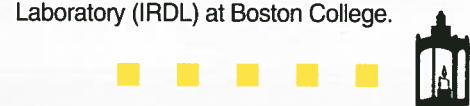
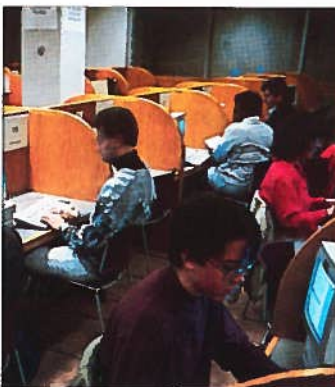
Innovative programs for K-12 teachers for which commitments have been secured to date include The Jason Project, geoscience software from Tom Snyder Productions and IBM, laser discs from WGBH in Boston, EME, Video-Discovery, presentations from the Annenberg/CPB Project, and applications of Internet connectivity by the Arlington (Massachusetts) Public School.

BOSTON COLLEGE

Science Classroom of the Future is made possible through an arrangement with the Department of Geology and Geophysics, Boston College. The college originated out of the Jesuit tradition of education and research in the sciences, which since 1540 has accorded preeminence to astronomy, geophysics, geology, and mathematics. Weston Observatory evolved from Weston College Seismological Laboratory, established on the new science of seismology, as part of a worldwide collaboration among Jesuit colleges and universities since 1908.

Weston Observatory, founded in 1928, spawned the graduate Department of Geophysics in 1947, and Father Jim Skehan founded the undergraduate Department of Geology in 1957 at Boston College. Both departments merged into the present Department of Geology and Geophysics, now housed in newly renovated, state-of-the-art facilities in Devlin Hall on the Chestnut Hill Campus.

The newly renovated laboratory complex at Weston Observatory is a research facility in geophysics and geology, and is the recording center for the 25-station three-component New England Seismic Network. It is also the headquarters of the GIS Center, with fiber-optic links to the departmental computers at the Chestnut Hill Campus, and to the university's Computer Center. The *Science Classroom of the Future* will be modeled on the prototype classroom developed by the Instructional Research and Development Laboratory (IRDLD) at Boston College.



■ Nubble Light on Cape Neddick, southern Maine. Rock is Cretaceous gabbro, among the youngest rock units in Maine. Photo by Joseph T. Kelley.



CHARGING INTO THE FUTURE

1993 ANNUAL MEETING

Boston, Massachusetts • October 25-28

ABSTRACTS DUE JULY 7 FOR ABSTRACT FORMS (303) 447-8850

PREREGISTRATION MUST BE RECEIVED BY SEPTEMBER 24

TRANSPORTATION, HOUSING, AND PROGRAM INFORMATION:
(303) 447-2020 or 1-800-472-1988

ISSN 1052-5173

The Geological Society of America
3300 Penrose Place
P.O. Box 9140
Boulder, CO 80301

SECOND CLASS
Postage Paid
at Boulder, Colorado
and at additional mailing offices