

GSA TODAY

A Publication of the Geological Society of America



TORONTO

1998 Annual Meeting
October 26-29

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The Geological Society of America

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DEADLINES

Abstracts due July 13

Preregistration and Housing (forms enclosed) due September 18

FOR MORE INFORMATION

Call: (303) 447-2020 or 1-800-472-1988

Fax: 303-447-0648

E-mail: meetings@geosociety.org

Web: www.geosociety.org/meetings/98

Assembly of a Continent



1998 Annual Meeting Committee



Welcome to Canada!

In particular, I welcome you back to Toronto where, in 1889, the Geological Society of America met for the first time under its "new" name and approved its original constitution. There have been nine GSA annual meetings in Canada, one in Montreal (1897), three in Ottawa (1892, 1905, and 1947) and five in Toronto (1889, 1930, 1953, 1978, and 1998).

Canadian geologists have always taken an active role in the GSA and its associated societies (twelve were listed as GSA Fellows in 1889). Since Sir William Dawson (McGill University, Montreal) was elected GSA President in 1893, seven other Canadians from both government and university positions, have followed in his footsteps, most recently R. E. Folinsbee (1976, University of Alberta), D. J. McLaren (1982, Geological Survey of Canada), and R. A. Price (1990, Geological Survey of Canada and Queen's University). U.S.-based geologists have made many distinguished contributions north of the border, one of which will be recognized in November 1998 when former GSA President Brian Skinner will receive an honorary degree from the University of Toronto.

The technical program shows a wide selection of topics with substantial emphasis on continental-scale processes. We hope to match the 1978 experience of the second highest attendance to that date for a GSA Annual Meeting and encourage you to register, arrive early, and stay late. In addition to your preferred technical sessions or field trip, take time to enjoy some of the local amenities of Toronto and southern Ontario.

Our theme for the Technical Program of this 110th GSA meeting is Assembly of a Continent, with both geological and social connotations, and the accompanying logo, based loosely on a Paul Hoffman map, with its lack of political boundaries, emphasizes the international scope of our discipline and our meeting.

—1998 General Chair J. Jeffrey Fawcett

- General Chair: *J. Jeffrey Fawcett, University of Toronto*
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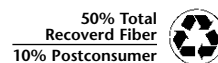
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This publication is included on GSA's annual CD-ROM, *GSA Journals on Compact Disc*. Call GSA Publication Sales for details.

Printed in U.S.A. using pure soy inks.



How To Submit Your Abstract

ABSTRACT DEADLINE: JULY 13

Please submit only one copy of your abstract—either electronic or paper.

SUBMIT ABSTRACTS VIA THE WEB (www.geosociety.org)

Abstracts for this year's GSA Annual Meeting in Toronto can be sent now to GSA via the World Wide Web. **Note that you can send electronic abstracts to GSA only via the Web. They may not be sent by ordinary e-mail.**

For the present, this system will accept only abstracts containing pure ASCII content; no graphics, tables, symbols, Greek, superscripts, etc. may be included. If you must use these in your abstract, use the paper form for now. We hope to be able to include non-ASCII material in the future, but for most users the technology for that is not yet in place. However, if your entire content—title, addresses, and abstract body—is pure ASCII and you have access to the Web, the new system will make life much easier by eliminating the more onerous tasks usually connected with preparation of paper forms.

The best part is that it takes only a few seconds to send an abstract and even less to get feedback from GSA. There will be no more mystery about whether we received your submission. You'll receive an immediate confirmation of receipt from GSA, with an abstract number assigned, while you're still on the Web. Note: Some Web client servers cut off their customers prematurely. The Web page has advice about this problem and has suggestions for use of appropriate browser options.

PAPER STILL WORKS WELL

The electronic system has not yet replaced the familiar paper version of GSA's abstract form. Rather, the two systems operate in parallel. Paper forms already have been distributed for 1998, and they can be obtained from GSA's Abstracts Coordinator: ncarlson@geosociety.org or call (303) 447-2020, ext. 161.

Paper abstract forms are available from:

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

ONLY ONE VOLUNTEERED ABSTRACT MAY BE SUBMITTED

Please submit only one volunteered abstract as speaker or poster presenter in discipline and/or theme sessions. Multiple submissions as speaker-presenter may result in rejection of all your abstracts. Since almost all of the sub-

IT'S EASY TO SUBMIT ELECTRONICALLY (www.geosociety.org)

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

mitted abstracts are accepted, this helps avoid speaker-scheduling conflicts and gives everyone an equal opportunity to be heard. Note that this limitation does not apply to, nor does it include, invited contributions to symposia.

ABSTRACTS FEE

Costs for implementing an electronic abstract submission system, as well as increasing costs for producing the printed *Abstracts with Programs* books, have led to establishment of a *\$15 abstract fee* for GSA Annual Meetings. Implementation of the fee follows the standard set by many other scientific organizations many years ago. The nonrefundable fee must be sent with both paper copy and electronic submissions.

PRESENTATION MODES

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

POSTER MODE—Each poster session speaker is provided with two horizontal, freestanding display boards approximately 8' wide and 4' high. Precise measurements will appear in the **Speaker Guide**. 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, however, are to be submitted only in the mode noted in the theme description. If a theme abstract is submitted in the incorrect mode, the abstract will be transferred automatically to a discipline session.

ALL ABSTRACTS DUE AT GSA: JULY 13

JOINT TECHNICAL PROGRAM COMMITTEE FINALIZES PROGRAM: AUGUST 7

The JTPC selects abstracts and determines the final session schedule. Speakers will be notified by August 24 (probably much sooner for abstracts submitted electronically). The JTPC consists of representatives from

each of GSA's Associated Societies and Divisions participating in the technical program. The JTPC technical program chairs were nominated by the Toronto Annual Meeting Committee and approved by the GSA Council.

FULL TECHNICAL PROGRAM SCHEDULE: SEPTEMBER 1

The full daily technical session schedule will appear in the September issue of *GSA Today* and at www.geosociety.org. If you are not a GSA member, please contact us, and we will gladly send you the schedule after September 1.

PLEASE SUBMIT ONLY ONE COPY OF YOUR ABSTRACT — EITHER ELECTRONIC OR PAPER

Abstracts with Programs

The *Abstracts with Programs* may be purchased in advance of the meeting (it is not part of the registration fee). For your convenience, a mail-in coupon appears on page 32. Remember you may have already purchased your copy with your membership dues. Also, you may pick up a copy on site in the registration area. For other advance sales, contact Publication Sales, GSA headquarters 1-800-472-1988, ext. 152. Member cost: US\$31, Nonmember cost: US\$38.75.

All invited abstracts (electronic and paper) are to be sent to GSA, which will forward the abstracts to the conveners for review.

NEW FOR '98! INTRODUCING PARDEE KEYNOTE SYMPOSIA

The first of the new Pardee Keynote Symposia will be presented this year. These symposia will be on the leading edge in a scientific discipline or area of public policy, address a broad fundamental problem, be interdisciplinary, or focus on global problems. Proposals included both a rationale for becoming a keynote symposium and a list of proposed speakers. Selection was on a competitive basis. This year's four Pardee Symposia were reviewed and accepted by the Annual Program Committee.

Support for this new keynote symposia series is from the Joseph T. Pardee Memorial Fund that was established with a generous gift from the estate of Joseph T. Pardee.

**ABSTRACT
DEADLINE
JULY 13**

K1 ■ TECTONIC EVOLUTION OF PRE-CAMBRIAN NORTH AMERICA I—A SYNTHESIS OF RECENT RESULTS

Lithoprobe; GSA Structural Geology and Tectonics Division; GSA Geophysics Division; 1998 Annual Meeting Committee. Ron M. Clowes, Lithoprobe, British Columbia, Canada; John A. Percival, Geological Survey of Canada, Ottawa; Karl Karlstrom, University of New Mexico. Monday, October 26, 8:00 a.m. to 12:00 noon.

K2 ■ PATHFINDER AND GLOBAL SURVEYOR: NEW VIEWS OF MARS

GSA Planetary Geology Division. Daniel T. Britt, University of Arizona Lunar and Planetary Laboratory. Thursday, October 29, 8:00 a.m. to 12:00 noon.

K3 ■ GEOLOGY AND BIOLOGY OF EARLY ANIMAL EVOLUTION

Paleontological Society. Desmond Collins, Royal Ontario Museum, Toronto; Nick Butterfield, Cambridge University, United Kingdom. Tuesday, October 27, 8:00 a.m. to 12:00 noon.

K4 ■ DEEP CRUSTAL PROCESSES

International Lithosphere Program; GSA Geophysics Division; GSA Structural Geology and Tectonics Division; Geological Association of Canada, Canadian Geophysical Union; International Association of Geomagnetism and Aeronomy; International Association of Seismology and Physics of the Earth's Interior; International Association of Volcanism and Chemistry of the Earth's Interior; American Geophysical Union. Alan G. Jones, Geological Survey of Canada, Ottawa; David Fountain, University of Wyoming; Walter D. Mooney, U.S. Geological Survey, Menlo Park; Randall Parrish, NERC Isotope Geosciences Laboratory, United Kingdom. Wednesday, October 28, 8:00 a.m. to 12:00 noon.

SYMPOSIA

S1 ■ GEOLOGIC CONTEXTS FOR PRE-CLOVIS ARCHAEOLOGICAL DEPOSITS IN THE AMERICAS

GSA Archaeology Division. C. Reid Ferring, University of North Texas, Denton. Tuesday, October 27, p.m.

S2 ■ CONTROLS ON SEDIMENTATION AND STRATIGRAPHY IN MAJOR COAL-PRODUCING BASINS OF NORTH AMERICA

GSA Coal Geology Division. Cortland E. Eble, Kentucky Geological Survey; C. Blaine Cecil, U.S. Geological Survey, Reston. Monday, October 26, a.m.

S3 ■ ENVIRONMENTAL QUALITY VS. ECONOMIC DEVELOPMENT: THE ROLE OF COAL IN DEVELOPING NATIONS

GSA International Division; GSA Coal Geology Division; U.S. Geological Survey; Geological Survey of Canada; Institute for Environmental Education. Allan Kolker, U.S. Geological Survey, Reston; L. Lynn Chyi, University of Akron; Fari Goodarzi, Geological Survey of Canada, Alberta. Thursday, October 29, a.m.

S4 ■ ACCRETING THE CONTINENT'S COLLECTIONS OF EARTH SCIENCE INFORMATION

Geoscience Information Society. Charlotte R. M. Derksen, East Palo Alto, California; Connie J. Manson, Washington Division of Geology and Earth Resources, Olympia. Tuesday, October 27, a.m.

S5 ■ THE VOISEY'S BAY Ni-Cu-Co DEPOSIT: A WORLD-CLASS ORE DEPOSIT AT THE JUNCTION OF TWO FORMER CONTINENTS

Society of Economic Geologists; 1998 Annual Meeting Committee. A. J. Naldrett, University of Toronto. Sunday, October 25, p.m.

S6 ■ THE LAC DE GRAS DIAMONDFEROUS KIMBERLITE FIELD, NORTH-WEST TERRITORIES, CANADA

Society of Economic Geologists. A. Lee Barker, Southern Era Resources Ltd., Toronto; Buddy Doyle, Kennecott Canada Exploration, Inc., Vancouver; Jon Carlson, BHP Diamonds, Inc., Kelowna, British Columbia. Wednesday, October 28, a.m.

S7 ■ MILITARY APPLICATIONS OF ENGINEERING GEOLOGY

GSA Engineering Geology Division. Judy Ehlen, U.S. Army, Topographic Engineering Center, Alexandria, Virginia; M. Merrill Stevens, University of Missouri—Rolla; Russell S. Harmon, U.S. Army Research Office, Research Triangle Park, North Carolina. Monday, October 26, a.m.

S8 ■ RESEARCH ISSUES IN PETROLEUM AND ENVIRONMENTAL ORGANIC GEOCHEMISTRY

Geochemical Society (Organic Geochemistry Division). Michael D. Lewan, U.S. Geological Survey, Denver; Barbara Sherwood Lollar, University of Toronto. Sunday, October 25, a.m./p.m.

S9 ■ GEOCHEMICAL INDICATORS OF ATMOSPHERIC INPUTS INTO TERRESTRIAL AND MARINE ENVIRONMENTS

Geochemical Society. Oliver A. Chadwick, University of California, Santa Barbara; Rosemary C. Capo, University of Pittsburgh. Monday, October 26, p.m.

S10 ■ DEVELOPING SUSTAINABILITY CURRICULA: A CHALLENGE FOR EARTH SCIENCES EDUCATORS

National Association of Geoscience Teachers; Institute for Environmental Education, GSA ad hoc Committee on Critical Issues. Paul H. Reitan, University of Buffalo; Trileigh Stroh, Seattle University; Paul R. Pinet, Colgate University. Tuesday, October 27, p.m.



Concretions, Slate River, Thunder Bay, Ontario —Photo by E. B. Freeman

S11 ■ STUDENT RESEARCH SYMPOSIUM

Sigma Gamma Epsilon. James C. Walters, University of Northern Iowa, Cedar Falls; Charles J. Mankin, Oklahoma Geological Survey. POSTER. Tuesday, October 27, p.m.

S12 ■ GEOSCIENCE EDUCATION: PREDICTIONS FOR THE 21ST CENTURY

National Association of Geoscience Teachers. Barbara J. Tewksbury, Hamilton College, Clinton, New York. Wednesday, October 28, a.m.

S13 ■ CONVERSATIONS WITH THE EARTH: PHILOSOPHERS AND GEOSCIENTISTS IN DIALOGUE ON THE ROLE OF THE EARTH SCIENCES IN SOCIETY

Institute for Environmental Education; International Association for Environmental Philosophy. Robert Frodeman, University of Tennessee; Victor R. Baker, University of Arizona. Tuesday, October 27, p.m.

S14 ■ HUTTON, LYELL, LOGAN—AND THEIR INFLUENCE IN NORTH AMERICA

GSA History of Geology Division. Gerard V. Middleton, McMaster University, Hamilton; Keith Tinkler, Brock University, St. Catharines, Ontario; Robert H. Dott, Jr., University of Wisconsin, Madison. Monday, October 26, p.m.

S15 ■ IEE ANNUAL ENVIRONMENTAL FORUM: THE SUSTAINABILITY CHALLENGE I: ENERGY FOR THE 21ST CENTURY

Institute for Environmental Education; GSA ad hoc Committee on Critical Issues. Allison R. (Pete) Palmer, Institute for Cambrian Studies, Boulder, Colorado; E-an Zen, Reston, Virginia. Sunday, October 25, p.m.

S16 ■ RESEARCH OPPORTUNITIES IN THE EARTH SCIENCES: A TEN-YEAR VISION

National Research Council; National Science Foundation. J. Freeman Gilbert and Craig M. Schiffrins, National Research Council—National Academy of Sciences, Washington, D.C.; Ian MacGregor, National Science Foundation, Arlington, Virginia. Tuesday, October 27, a.m.

S17 ■ FAULT REACTIVATIONS, NEO-TECTONICS, AND SEISMICITY IN THE GREAT LAKES REGION

Geological Association of Canada; GSA Structural Geology and Tectonics Division. Robert Jacobi, State University of New York at Buffalo; C. F. M. Lewis, Geological Survey of Canada, Dartmouth, Nova Scotia; Joe Wallach, JLV Geosciences, Russell, Ontario. Wednesday, October 28, a.m.

S18 ■ DEFORMATION MECHANISMS AND MICROSTRUCTURES

GSA Structural Geology and Tectonics Division. W. D. Means, University of Albany. Monday, October 26, p.m.

S19 ■ ACCRETIONARY MARGINS OF NORTH AMERICA

Cushman Foundation. Charles A. Ross, Western Washington University, Bellingham. Tuesday, October 27, a.m.

Assembly of International Surveys

INTERNATIONAL SURVEYS INVITED TO GSA TORONTO

The 1998 Annual Meeting Committee is inviting geologists from national geological surveys around the world to participate in a program in conjunction with the Toronto meeting. As in the International Surveys Program (ISP) that debuted at the 1997 GSA Annual Meeting in Salt Lake City, the ISP delegates will present technical papers and exhibits on new geological and environmental developments in their home countries. Visit the delegates in the exhibit hall at the Metro Toronto Convention Centre from Sunday, October 25, through Wednesday, October 28. This is a great opportunity to compare geological notes with your colleagues from around the world.

Information: Richard A. F. Grieve, Earth Sciences Sector, Natural Resources Canada, 601 Booth St., Ottawa, ON, K1A 0E8, Canada, (613) 995-5372, rgrieve@nrcan.gc.ca; or Blyth Robertson, Geological Survey of Canada, 601 Booth St., Ottawa, ON, K1A 0E8, Canada, (613) 996-4239, blrobert@nrcan.gc.ca.

Cosponsored by the Geological Society of America and the Geological Survey of Canada.

S20 ■ ROLE OF PARTIAL MELTING DURING EVOLUTION OF CONVERGENT OROGENIC BELTS

GSA Structural Geology and Tectonics Division. Michael Edwards, State University of New York at Albany; Olivier Vanderhaeghe, Dalhousie University, Halifax, Nova Scotia; Christian Teysier, University of Minnesota. Wednesday, October 28, p.m.

S21 ■ EXPERIMENTAL PETROLOGY AND APPLICATIONS: A TRIBUTE TO 35 YEARS OF RESEARCH IN THE GOLD-SMITH-NEWTON LABORATORY AT THE UNIVERSITY OF CHICAGO

Mineralogical Society of America; Geochemical Society. Dexter Perkins, University of North Dakota, Grand Forks; Andrea Koziol, University of Dayton; David Jenkins, Binghamton University, New York; David R. Pattison, University of Calgary. Tuesday, October 27, p.m.

S22 ■ LOCATING OLD MANTLE PLUMES

GSA Geophysics Division; Geophysics Division of the Geological Association of Canada; GSA International Division. Richard E. Ernst and Kenneth L. Buchan, Geological Survey of Canada, Ottawa; Millard F. Coffin, University of Texas at Austin. Thursday, October 29, a.m.

S23 ■ NORTH AMERICAN ICE SHEETS DURING MARINE ISOTOPE STAGES 3 TO 1: EXTENT, CHRONOLOGY, DATA, AND MODELING

GSA Quaternary Geology and Geomorphology Division. John T. Andrews, University of Colorado, Boulder; A. S. Dyke, Geological Survey of Canada, Ottawa. Monday, October 26, a.m.

S24 ■ APPLICATION OF COSMOGENIC NUCLIDES IN SURFICIAL PROCESSES AND GLOBAL CHANGE STUDIES

GSA Sedimentary Geology Division; GSA Quaternary Geology and Geomorphology Division. John Gosse, University of Kansas; Jeffrey Klein, University of Pennsylvania. Wednesday, October 28, p.m.

S25 ■ RESPONSE TO HOLOCENE CLIMATE CHANGE ON THE GREAT PLAINS

GSA Quaternary Geology and Geomorphology Division; Geological Survey of Canada; Global

Change and Climate History Program, U.S. Geological Survey. Stephen Wolfe, Geological Survey of Canada, Ottawa; Daniel Muhs, U.S. Geological Survey, Denver. Wednesday, October 28, a.m.

S26 ■ PALEOECOLOGICAL AND GEOCHEMICAL SIGNATURE OF CRETACEOUS ANOXIC EVENTS: A MEMORIAL TO WILLIAM V. SLITER

Cushman Foundation; 1998 Annual Meeting Committee. Timothy J. Bralower, University of North Carolina, Chapel Hill; Brian Huber, Smithsonian Institution, Washington, D.C.; R. Mark Leckie, University of Massachusetts. Monday, October 26, a.m.

S27 ■ UNDERSTANDING GROUNDWATER IN ARID AND SEMI-ARID ENVIRONMENTS OF NORTH AMERICA AND AUSTRALIA

GSA Hydrogeology Division. Todd Halihan and John M. Sharp, Jr., University of Texas at Austin; Craig T. Simmons, Flinders University of South Australia, Adelaide. Sunday, October 25, p.m.

S28 ■ MULTIMODAL HETEROGENEITY IN CLASTIC AQUIFERS: QUANTIFYING PERMEABILITY AND LITHOFACIES DISTRIBUTIONS

GSA Hydrogeology Division; SEPM (Society for Sedimentary Geology). Robert W. Ritzi, Jr., and David F. Dominic, Wright State University, Dayton, Ohio; J. Matthew Davis, University of New Hampshire, Durham. Monday, October 26, p.m.

S29 ■ BREAKING DOWN BARRIERS: COMMUNICATING RELEVANT GEOSCIENCE ISSUES TO THE PUBLIC

Science Awareness through Geoscience Education. John J. Clague, and Robert J. Turner, Geological Survey of Canada, Vancouver; Michelle Lamberson, University of British Columbia, Vancouver. Monday, October 26, p.m.

S30 ■ INTERNATIONAL SURVEYS.

1998 Annual Meeting Committee. Richard A. F. Grieve, Natural Resources Canada; Blyth Robertson, Geological Survey of Canada. POSTER. Monday, October 26, p.m.

Discipline and Theme Sessions (Volunteered Papers)

DISCIPLINE SESSIONS

Papers are submitted to ONE scientific discipline. The JTPC representatives organize the papers in sessions focused on this discipline—for example, hydrogeology or mineralogy.

YOU ARE WELCOME TO SUBMIT ONLY ONE VOLUNTEERED ABSTRACT

THEME SESSIONS

Papers are submitted to a specific pre-announced title and to ONE scientific category. Theme sessions are interdisciplinary; each theme may have as many as three categories from which authors may choose ONE. After each theme description below, the categories are identified by name and number as they appear on the 1998 Abstract Form. PLEASE SUBMIT ONLY IN THE MODE AND CATEGORIES INDICATED in the description (oral or poster). An abstract submitted in the incorrect mode will be transferred automatically to a discipline session.

EXAMPLE SUBMISSION

Theme submissions must include:

- Theme number—T18
- Key words of the theme title—*Methods for Quantifying Unsaturated Permeability*
- One category—*Environmental Geology* (#6 on abstract form)
- Mode for the session—*Poster*

ROLE OF THEME ADVOCATE

Each theme session has been proposed by an advocate. Advocates may not invite speakers; however, they may encourage colleagues to submit abstracts, with the understanding that there is no guarantee of acceptance. JTPC representatives, in consultation with the theme advocates, will organize theme sessions by August 7.

THEME TOPICS

Please check the *correct mode* of the theme session—poster or oral. If the abstract is submitted inaccurately, it will be transferred automatically to a discipline session.

T01 ■ GOLD DEPOSITS ASSOCIATED WITH ALKALIC ROCKS

Society of Economic Geologists. A. Lee Barker, Southern Era Resources Ltd., Toronto; Jeremy Richards, University of Alberta; Paul G. Spry, Iowa State University. ORAL
Economic Geology [4], Geochemistry, Other [8], Mineralogy/Crystallography [16]

T02 ■ NATURAL SOURCES OF MERCURY AND ARSENIC: SIGNIFICANCE IN REGIONAL CYCLES AND ENVIRONMENTAL ASSESSMENTS

Institute for Environmental Education. Mae Sexauer Gustin, University of Nevada, Reno; Alan H. Welch, U.S. Geological Survey, Carson City, Nevada. ORAL
Environmental Geology [6], Geochemistry, Other [8]

T03 ■ EL NIÑO 1997–1998: EFFECTS ON EARTH SURFACE PROCESSES

GSA Engineering Geology Division; GSA Quaternary Geology and Geomorphology Division. Scott F. Burns, Portland State University; Vincent Cronin, University of Wisconsin, Milwaukee. ORAL
Engineering Geology [5], Quaternary Geology/Geomorphology [26], Geoscience Information [11]

T04 ■ LANDSLIDES AND TRANSPORTATION SYSTEMS

GSA Engineering Geology Division. Scott F. Burns, Portland State University; Jerry DeGraff, U.S. Forest Service, Sierra National Forest, Clovis, California. ORAL
Engineering Geology [5], Quaternary Geology/Geomorphology [26], Public Policy [25]

T05 ■ ENVIRONMENTAL AND ENGINEERING GEOLOGY IN QUATERNARY DEPOSITS

GSA Engineering Geology Division; GSA Quaternary Geology and Geomorphology Division. Scott F. Burns, Portland State University; Paul Karrow, University of Waterloo, Ontario. ORAL
Engineering Geology [5], Environmental Geology [6], Quaternary Geology/Geomorphology [26]

T06 ■ GEOMICROBIOLOGY

Gordon Southam, Northern Arizona University; Kurt Konhauser, University of Leeds, Leeds, United Kingdom. ORAL
Geochemistry, Aqueous/Organic [7], Mineralogy/Crystallography [16]

T07 ■ SOURCES, TRANSPORT, FATE, AND TOXICOLOGY OF TRACE ELEMENTS IN THE ENVIRONMENT

International Association of Geochemistry and Cosmochemistry, in memory of Helen L. Cannon. Gunter Faure, Ohio State University; David T. Long, Michigan State University. ORAL
Geochemistry, Aqueous/Organic [7], Economic Geology [4], Environmental Geology [6]

T08 ■ CONTINENT FORMATION, GROWTH, AND RECYCLING

Paul J. Sylvester, Australian National University, Canberra, Australia. ORAL
Geochemistry, Other [8], Petrology, Igneous [21], Precambrian Geology [24]

T09 ■ LUMINESCENCE IN GEOLOGY—10TH ANNIVERSARY MEETING OF SOCIETY OF LUMINESCENCE MICROSCOPY AND SPECTROSCOPY

Society of Luminescence Microscopy and Spectroscopy. William J. Meyers, State University of New York at Stony Brook; Pete Modreski, U.S. Geological Survey, Denver; Maurice Pagel, Université de Paris, Paris, France. ORAL
Geochemistry, Other [8], Mineralogy/Crystallography [16], Sediments, Carbonates [28]

T10 ■ FIELD CAMP PEDAGOGIES: ADJUSTING TO MODERN EQUIPMENT AND THE MODERN STUDENT

Patrick A. Burkhart, Slippery Rock University, Slippery Rock, Pennsylvania; Gregory S. Baker, University of Kansas, Lawrence. ORAL
Geology Education [9]

T11 ■ BREAKING DOWN BARRIERS: COMMUNICATING RELEVANT GEOSCIENCE ISSUES TO THE PUBLIC

Science Awareness through Geoscience Education; Institute for Environmental Education. John J. Clague and Robert J. Turner, Geological Survey of Canada, Vancouver; Michelle Lamberson, University of British Columbia, Vancouver. ORAL and POSTER
Geology Education [9], Geoscience Information [11]

T12 ■ TEACHING HYDROGEOLOGY TO UNDERGRADUATE AND GRADUATE STUDENTS

GSA Hydrogeology Division, National Association of Geoscience Teachers. Science Awareness through Geoscience Education. Laura L. Sanders, Northeastern Illinois University, Chicago; Tim Allen, Keene State College, Keene, New Hampshire. ORAL
Geology Education [9], Hydrogeology [13], Environmental Geology [6]

T13 ■ CREATING LEARNING ENVIRONMENTS WITH THE INTERNET AND MULTIMEDIA

National Association of Geoscience Teachers; American Geological Institute. John C. Butler, University of Houston; Warren Huff, University of Cincinnati; Michelle Lamberson, University of British Columbia, Vancouver. ORAL
Geology Education [9], Computers [3], Geoscience Information [11]

T14 ■ TEACHING THROUGH INQUIRY IN THE GEOSCIENCES

National Association of Geoscience Teachers; GSA Geoscience Education Division. Judi Kusnick, California State University, Sacramento; Barbara Manner, Duquesne University, Pittsburgh. ORAL
Geology Education [9]

T15 ■ EDUCATION ABOUT THE ENVIRONMENT: WHAT WORKS!

National Association of Geoscience Teachers; Institute for Environmental Education. David Barclay, Paul H. Reitan, and Marcus I. Bursik, University of Buffalo. POSTER
Geology Education [9], Environmental Geology [6]

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T16 ■ GEOTECTONICS AT THE FRONTIER: A CENTENARY TRIBUTE TO DEBATE, REJECTION, AND ACCEPTANCE OF CRUSTAL DYNAMICS PARADIGMS IN THE GEOSCIENCES

John James Murray, University of Manitoba, Winnipeg; Gerald S. Smerchanski, University of Minnesota. ORAL

Geology Education [9], Planetary Geology [23], History of Geology [12]

T17 ■ NORTH AMERICAN GEOLOGY IN THE EARLY TO MIDDLE NINETEENTH CENTURY

GSA History of Geology Division. Gerard V. Middleton, McMaster University, Hamilton, Ontario; Keith Tinkler, Brock University, St. Catharines, Ontario; Robert H. Dott, Jr., University of Wisconsin, Madison. ORAL
History of Geology [12]

T18 ■ RESEARCH OPPORTUNITIES IN THE EARTH SCIENCES: A TEN-YEAR VISION

National Research Council; National Science Foundation. J. Freeman Gilbert and Craig M. Schiffries, National Research Council–National Academy of Sciences, Washington, D.C.; Ian MacGregor, National Science Foundation, Arlington, Virginia. POSTER
Public Policy [25]

T19 ■ GEOPHYSICAL STUDIES OF THE CRUST AND LITHOSPHERE

GSA Geophysics Division; GSA Structural Geology and Tectonics Division. Walter D. Mooney, U.S. Geological Survey, Menlo Park. ORAL

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

T20 ■ CONTROLS ON THE STYLE, DISTRIBUTION, AND INTENSITY OF DEFORMATION AROUND FAULTS AND FOLDS

GSA Structural Geology and Tectonics Division. Mark P. Fischer, Northern Illinois University, De Kalb. ORAL

Structural Geology [31], Tectonics [32], Petroleum Geology [19]

T21 ■ FROM CRACKS TO CREEP: EVOLUTION, BEHAVIOR, AND PROCESSES WITHIN MATURE FAULT ZONES

GSA Structural Geology and Tectonics Division. Joseph Clancy White, University of New Brunswick, Fredericton. ORAL

Structural Geology [31], Geophysics/Tectonophysics [10], Petroleum Geology [19]

T22 ■ WHAT ARE WE DATING? UNDERSTANDING THE CRYSTALLOGENESIS OF U-Pb GEOCHRONOMETERS

GSA Structural Geology and Tectonics Division. Desmond Moser, University of Utah; David Scott, Geological Survey of Canada, Ottawa. ORAL and POSTER

Tectonics [32], Petrology, Metamorphic [22], Geochemistry, Other [8]

T23 ■ DEEP CRUSTAL PROCESSES

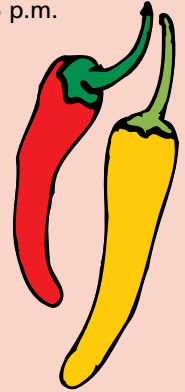
International Lithosphere Program; GSA Geophysics Division; GSA Structural Geology and Tectonics Division; Geological Association of Canada, Canadian Geophysical Union; International Association of Geomagnetism and Aeronomy; International Association of Seismology and Physics of the Earth's Interior;

Hot Topics at Noon

POPULAR SCIENTIFIC DEBATE AND LUNCH

Monday through Thursday, October 26 through 29, 12:15 to 1:15 p.m.
Metro Toronto Convention Centre

Join your colleagues in spirited lunch-time debates. Bring your lunch, or buy the hot (or mild) red and green chili available for purchase outside the debate room, along with other foods, beer, and soft drinks.



■ INTRINSIC REMEDIATION AND HYDROGEOLOGY: BEAUTY AND THE BEAST?

Monday, October 26.

D. Mackay, University of Waterloo, d4mackay@cgrnserc.uwaterloo.ca; S. Feenstra, Applied Groundwater Research Ltd., dnapl@ultratech.net

■ EXTRATERRESTRIAL CHEMISTRY—IMPLICATIONS FOR ORIGIN OF LIFE ON EARTH

Tuesday, October 27.

S. A. Macko, University of Virginia, sam8f@virginia.edu; and Everett L. Shock, Washington University, shock@zonvark.wustl.edu.

■ WHAT IS THE FUTURE FOR SCIENTIFIC OCEAN DRILLING?

Wednesday, October 28. Sponsored by *GEOLOGY*.

Michael A. Arthur, Pennsylvania State University, University Park, (814) 865-6711.

■ IS ACCREDITATION OF THE PROFESSIONAL DEGREE IN GEOSCIENCE NEEDED?

Thursday, October 29. Sponsored by the *American Geological Institute*.

Robert D. Hatcher, Jr., University of Tennessee, Knoxville, and Oak Ridge National Laboratory, bobmap@utk.edu; P. Geoffrey Feiss, College of William and Mary (757) 221-2470; Robert G. Corbett, Illinois State University, rcorbett@ilstu.edu.

International Association of Volcanism and Chemistry of the Earth's Interior; American Geophysical Union. Alan G. Jones, Geological Survey of Canada, Ottawa; David Fountain, University of Wyoming; Walter D. Mooney, U.S. Geological Survey, Menlo Park; Randall Parrish, NERC Isotope Geoscience Laboratory, Keyworth, United Kingdom. ORAL and POSTER
Tectonics [32], Geophysics/Tectonophysics [10], Geochemistry, Other [8]

T24 ■ TECTONIC EVOLUTION OF PRECAMBRIAN NORTH AMERICA

Lithoprobe; GSA Structural Geology and Tectonics Division; GSA Geophysics Division; 1998 Annual Meeting Committee. Ron M. Clowes, University of British Columbia, Vancouver; John A. Percival, Geological Survey of Canada, Ottawa; Karl Karlstrom, University of New Mexico. ORAL and POSTER
Tectonics [32], Geophysics/Tectonophysics [10], Precambrian Geology [24]

T25 ■ NAFTA: NORTH AMERICAN FLOATING TERRANE ACCRETION

International Geological Correlation Program 376. Jarda Dostal, St. Mary's University, Halifax, Nova Scotia; J. Duncan Keppie, Universidad Nacional Autónoma de México, Mexico City. ORAL
Tectonics [32], Geophysics/Tectonophysics [10], Geochemistry, Other [8]

T26 ■ ROLE OF PARTIAL MELTING DURING EVOLUTION OF CONVERGENT OROGENIC BELTS

Michael Edwards, State University of New York at Albany; Christian Teyssier, University of Minnesota; Olivier Vanderhaeghe, Dalhousie University, Halifax, Nova Scotia. POSTER
Tectonics [32], Structural Geology [31], Petrology, Igneous [21]

T27 ■ APPLIED GEOLOGICAL REMOTE SENSING

International Union of Geological Sciences. Vern Singhroy, Canada Centre for Remote Sensing, Ottawa. ORAL
Remote Sensing [27]

T28 ■ ARCHEAN CRATONS: EVOLUTION AND ASSEMBLY

Tom Skulski, John Percival, and Wouter Bleeker, Geological Survey of Canada, Ottawa. ORAL
Precambrian Geology [24], Tectonics [32], Geophysics/Tectonophysics [10]

T29 ■ TONALITES, TRONDHEMITES, AND GRANODIORITES AND RELATED ROCKS: ANCIENT EXAMPLES AND MODERN ANALOGUES

Robert J. Stern, University of Texas at Dallas; A. Krishna Sinha, Virginia Polytechnic Institute; Makoto Arima, Yokohama National University, Yokohama, Japan; Takashi Nakajima, Geological Survey of Japan, Ibaraki, Japan. ORAL and POSTER
Petrology, Igneous [21]

T30 ■ ENVIRONMENTS AND TIMING OF THE LAST INTERGLACIATION: VEGETATION, PALEOHYDROLOGY, AND CLIMATE

GSA Quaternary Geology and Geomorphology Division. B. Brandon Curry, Illinois State Geological Survey, Champaign; Michel Lamothe, Université du Québec à Montréal; Richard G. Baker, University of Iowa. ORAL
Quaternary Geology/Geomorphology [26], Paleontology/Paleobotany [18], Paleoceanography/Paleoclimatology [17]

T31 ■ THE POWER OF PALEOLIMNOLOGY: STATE OF THE ART AND FUTURE DIRECTIONS

Marianne S. V. Douglas, University of Toronto; William M. Last, University of Manitoba, Winnipeg. ORAL and POSTER

Quaternary Geology/
Geomorphology [26], Paleoceanography/
Paleoclimatology [17], Environmental
Geology [6]

T32 ■ ON THE NATURE AND ORIGIN OF STONE LINES AND LITHOLOGIC DISCONTINUITIES IN SEDIMENTS AND SOILS

GSA *Quaternary Geology and Geomorphology Division*. Randall Schaeztl, Michigan State University; Donald Johnson, University of Illinois, Urbana. ORAL

Quaternary Geology/Geomorphology [26],
Archaeological Geology [1]

T33 ■ CONTINENTAL GLACIATIONS: CONTINUING DEBATES

Steven L. Forman, University of Illinois, Chicago; Julie Brigham-Grette, University of Massachusetts. ORAL

Quaternary Geology/
Geomorphology [26],
Paleoceanography/
Paleoclimatology [17],
Marine Geology [14]

T34 ■ TERRESTRIAL RECORDS OF LATE-GLACIAL AND HOLOCENE CLIMATE CHANGE IN THE AMERICAS

Donald T. Rodbell, Union College, Schenectady; Jan T. Heine, University of Washington; Mel A. Reasoner, Institute of Arctic and Alpine Research, University of Colorado; Geoffrey O. Seltzer, Syracuse University. ORAL

Quaternary Geology/Geomorphology [26],
Paleoceanography/Paleoclimatology [17]

T35 ■ HOLOCENE CLIMATE CHANGE ON THE GREAT PLAINS

GSA *Quaternary Geology and Geomorphology; Terrain Sciences Division, Geological Survey of Canada; Global Change and Climate History Program, U.S. Geological Survey*. Donald Lemmen, Geological Survey of Canada, Calgary. ORAL

Quaternary Geology/Geomorphology [26],
Paleoceanography/Paleoclimatology [17],
Stratigraphy [30]

T36 ■ SURFICIAL PROCESSES AND LANDSCAPE DYNAMICS WITHIN ARID AND DESERT ENVIRONMENTS

U.S. Army Research Office; *Desert Research Institute*. Russell Harmon, U.S. Army Research Office, Research Triangle Park, North Carolina; Steve Wells, Desert Research Institute, Reno, Nevada; Valerie Morrill, Conservation Program, U.S. Army, Yuma, Arizona. ORAL

Quaternary Geology/Geomorphology [26],
Environmental Geology [6]

T37 ■ PALEONTOLOGY SOLVES GEOLOGIC PROBLEMS

Paleontological Society; Society of Vertebrate Paleontology. Michael Woodburne and Nigel Hughes, University of California, Riverside. ORAL

Paleontology/Paleobotany [18],
Stratigraphy [30], Structural Geology [31]

T38 ■ THE END-PERMIAN MASS EXTINCTION: PALEOZOIC NEMESIS

Paul B. Wignall and Richard J. Twitchett, University of Leeds, Leeds, United Kingdom. ORAL
Paleontology/Paleobotany [18],
Stratigraphy [30], Geochemistry, Other [8]

T39 ■ PALEONTOLOGICAL DATABASES AND TAXONOMIC DECISIONS

Paleontological Society. Colin Stearn, McGill University, Montreal. ORAL
Paleontology/Paleobotany [18]

T40 ■ SEQUENCE STRATIGRAPHIC CONTROLS ON ORGANIC FACIES

Bradley B. Sageman, Northwestern University; Thomas J. Algeo, University of Cincinnati. ORAL

Stratigraphy [30], Geochemistry, Aqueous/
Organic [7], Petroleum Geology [19]

T41 ■ GEOLOGICAL EVOLUTION OF MEXICO: ITS RELATION TO CONTINUOUS NORTH AMERICA

José F. Longoria, Jr., Florida International University, Miami; Dante Moran Centeno, Universidad Nacional Autónoma de México, Mexico City; Rogelio Monreal, Universidad de Sonora, Hermosillo, México. ORAL
Stratigraphy [30], Tectonics [32],
Paleontology/Paleobotany [18]

T42 ■ ONSHORE-OFFSHORE CORRELATION OF CENOZOIC STRATA, WESTERN MARGIN OF NORTH ATLANTIC

W. Burleigh Harris, University of North Carolina, Wilmington; Marilyn Segall, Bountiful, Utah. ORAL and POSTER

Stratigraphy [30], Sediments, Clastic [29],
Sediments, Carbonates [28]

T43 ■ INTERPRETING FOSSIL EARTHQUAKES FROM THE STRATIGRAPHIC RECORD

Frank R. Effensohn and Nicholas Rast, University of Kentucky. ORAL

Stratigraphy [30], Engineering Geology [5]

T44 ■ GROUNDWATER SUSTAINABILITY

GSA *Hydrogeology Division; Institute for Environmental Education*. Abe Springer, Northern Arizona University; Scott Bair, Ohio State University. ORAL and POSTER
Hydrogeology [13], Environmental Geology [6],
Engineering Geology [5]

T45 ■ CAPTURE ZONES IN FRACTURED ROCK

Kent Novakowski, National Water Research Institute, Burlington, Ontario; Ed Sudicky, University of Waterloo, Ontario. ORAL
Hydrogeology [13]

T46 ■ SOLUTE TRANSPORT IN AQUITARDS: FIELD STUDIES

GSA *Hydrogeology Division*. Vicki Remenda, Queen's University, Kingston, Ontario; Garth van de Kamp, Environment Canada, Saskatoon, Saskatchewan. ORAL

Hydrogeology [13], Environmental Geology [6]

T47 ■ GROUNDWATER FLOW AND SOLUTE TRANSPORT INTO THE GREAT LAKES

GSA *Hydrogeology Division*. F. Edwin Harvey, University of Nebraska; Shaun K. Frape, University of Waterloo, Ontario. ORAL

Hydrogeology [13], Quaternary Geology/
Geomorphology [26], Geochemistry,
Aqueous/Organic [7]

T48 ■ RADIONUCLIDE TRANSPORT EXPERIMENTS AT UNDERGROUND RESEARCH LABORATORIES

U.S. Department of Energy/*Yucca Mountain Project*. Robert A. Levich and Russell L. Patterson, Las Vegas; Ronald M. Linden, Henderson, Nevada. ORAL

Hydrogeology [13], Geochemistry,
Aqueous/Organic [7], Environmental Geology [6]

T49 ■ HYDROGEOLOGIC CONTROLS ON ECOSYSTEMS

GSA *Hydrogeology Division; Institute for Environmental Education*. Edwin A. Romanowicz, Duke University; Andrew Reeve, University of Maine, Orono. ORAL

Hydrogeology [13], Quaternary
Geology/Geomorphology [26], Geochemistry,
Aqueous/Organic [7]

T50 ■ FROM CONTINENTAL SHELF TO ABYSSAL PLAIN—LINKS BETWEEN SEDIMENT TRANSPORT AND MORPHOLOGY

William W. Hay, GEOMAR, Kiel, Germany; David Goldberg, Lamont-Doherty Observatory, Columbia University. ORAL

Marine Geology [14], Sediments, Clastic [29],
Paleoceanography/
Paleoclimatology [17]

T51 ■ PALEOECOLOGICAL AND GEOCHEMICAL SIGNATURE OF CRETACEOUS ANOXIC EVENTS: A MEMORIAL TO WILLIAM V. SLITER

Cushman Foundation. Timothy J. Bralower, University of North Carolina, Chapel Hill; Brian Huber, Smithsonian Institution, Washington D.C.; R. Mark Keckie, University of Massachusetts. POSTER

Paleoceanography/
Paleoclimatology [17], Marine Geology [14],
Micropaleontology [15]

T52 ■ THE LAC DE GRAS DIAMONDIFEROUS KIMBERLITE FIELD, NORTH-WEST TERRITORIES, CANADA

Society of Economic Geologists. A. Lee Barker, Southern Era Resources Ltd., Toronto; Buddy Doyle, Kennecott Canada Exploration, Ltd., Toronto; Jon Carlson, BHP Diamonds, Inc., Kelowna, British Columbia. POSTER

Economic Geology [4]

T53 ■ ORIGIN AND TRANSPORT OF NON-HYDROCARBON GASES IN SEDIMENTARY BASINS

Chris Ballentine, University of Michigan; Barbara Sherwood Lollar, University of Toronto. ORAL

Geochemistry, Other [8], Petroleum Geology
[19], Geochemistry, Aqueous/Organic [7]

T54 ■ ASSEMBLING A NEW UNDERSTANDING OF MARS

GSA *Planetary Geology Division*. James R. Zimbelman, Smithsonian Institution; Kenneth S. Edgett, Arizona State University, Tempe. ORAL

Planetary Geology [23], Quaternary Geology/
Geomorphology [26], Geophysics/
Tectonophysics [10]

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PREREGISTRATION DEADLINE: SEPTEMBER 18

All trips begin and end in Toronto at the Metro Toronto Convention Centre, South Building, Bremner Boulevard entrance, unless otherwise indicated. If you register for a field trip only, you must pay a US\$35 nonregistrant fee in addition to the field trip fee. This fee may be applied toward meeting registration if you decide to attend the meeting.

Students, spouses, and interested guests are encouraged to attend. Trips are technical in nature, and some can be physically rigorous. Participants should be prepared for cold weather. Trips are one to five days in duration and led by active field researchers.

Trip fees include transportation during the trip and a guidebook. Other services are noted by the following symbols: B—breakfast, L—lunch, R—refreshments, D—dinner, and ON—overnight lodging.

The mode of transportation follows.

**FEES ARE GIVEN
IN U.S. DOLLARS**

Some returning buses for postmeeting trips can stop at the Toronto Airport to discharge participants who have evening flights or would prefer to stay in a hotel closer to the airport. Do not schedule tight travel connections with field trip return times, because those times are estimates, and delays in the field can occur. For a list of hotels near the airport and their phone numbers, see the GSA Web site or contact Edna Collis, GSA Field Trip Coordinator, GSA Headquarters, (303) 447-2020, ext.134, or ecollis@geosociety.org.

Preregistration deadline is September 18. Cancellation deadline is September 25. No refunds will be given after September 25. If GSA must cancel a field trip because of logistics or if minimum registration requirements are not met, a full refund will be issued to you after the meeting. Be aware of flight-change penalties imposed by the airlines. Plan alternatives in advance should the trip you are registered for be canceled.

For further information, contact the trip leader or the 1998 Field Trip Co-Chairs: Pierre-Yves F. Robin, (905) 828-5419, and Henry C. Halls, (905) 828-5363, Dept. of Geology, Erindale College, University of Toronto, 3359 Mississauga Road, Mississauga, ON, L5L 1C6, Canada, fax 905-828-3717, probin@erin.utoronto.ca or hhalls@erin.utoronto.ca.

PREMEETING

1. ■ FROM FRONT TO INTERIOR: AN ONTARIO TRANSECT OF THE GRENVILLE PROVINCE, SUDBURY TO THE ST. LAWRENCE

Wednesday, October 21 through Sunday, October 25. Cosponsored by *GSA Structural Geology and Tectonics Division*. A. (Tony) Davidson, Geological Survey of Canada, 601 Booth St., Ottawa, ON, K1A 0E8, Canada, (613) 995-4793, fax 613-995-9273, tdavidson@gsc.nrcan.gc.ca; Mike Easton. Maximum: 45; minimum: 18. Cost: \$370. (4B, 4L, 4D, R, 4ON, vans).

This trip will provide an overview of the southwestern Grenville Province in the light of recent metamorphic, geochronologic, and structural studies which, linked to LITHOPROBE seismic reflection surveys, have been the basis for tectonic modeling of this complex, Mesoproterozoic orogen. Excellent exposures along the transect afford an opportunity to examine critically the relationships between rocks of different ages in tectonically juxtaposed blocks of crust. From the Grenville Front and its immediate, early Paleoproterozoic, Southern Province foreland, the trip will proceed up structural section through various slices of high-grade rocks dominated by deformed, early Mesoproterozoic plutons, stacked together during Grenvillian orogeny along ductile shear zones in which remnants of eclogite are locally preserved. It will then pass across a major ductile thrust boundary into the Central Metasedimentary Belt, comprising relatively low-grade mid-Mesoproterozoic supracrustal and plutonic rocks specific to the Grenville orogen, and end in the core of the orogen where granulite-facies rocks host massifs of anorthosite and related granitoids.

2. ■ A WESTERN QUEBEC GRENVILLE TRANSECT

Thursday, October 22 through Saturday, October 24. Cosponsored by *GSA Structural Geology and Tectonics Division*. Jacques Martignole, Dept. de Géologie, Université de Montréal, Montréal, PQ, H3C 3J7, Canada,

(514) 343-7734, fax 514-343-5782, martigno@ere.umontreal.ca. This trip starts in Val-d'Or, Quebec (one-hour flight from Montreal) and ends at the Montreal International Airport. Maximum: 24; minimum: 11. Cost: \$335 (2B, 2L, 2D, R, 2ON, vans).

The aim of this trip is to make a complete (400 km long) cross section through the Grenville Province in western Quebec, essentially along Highway 117. For the most part, the road log will follow the Lithoprobe seismic profile carried out in the autumn of 1993. The field trip will start from the Grenville Front, and the first day will be entirely devoted to the study of amphibolite-grade Archean parautochthonous rocks (Sm-Nd model ages around 2.8 Ga) reworked during the Grenvillian orogenic cycle (monazite ages around 1 Ga; hornblende cooling ages around 0.96 Ga). The second day will be concentrated on high-grade Proterozoic allochthons (metamorphic ages around 1180 Ma and 1070 Ma; hornblende cooling ages around 1047 Ma). The third day will concentrate on the Morin terrane, mostly charnockitic and anorthositic with igneous ages between 1160 Ma and 1130 Ma. Emphasis will be on the modality of deformation both within and at the margins of the terrane.

3. ■ POSTGLACIAL SURFACE PROCESSES OF NORTHERN NEW ENGLAND

Thursday, October 22 through Sunday, October 25. Cosponsored by *GSA Quaternary Geology and Geomorphology Division*. Paul Bierman, Dept. of Geology, University of Vermont, Burlington, VT 05405-0122, (802) 656-4411, fax 802-656-0045, pbierman@zoo.uvm.edu; Andrea Lini, Stephen Wright, P. Thompson Davis. This trip will start in Burlington, Vermont, and end in Toronto. Maximum: 25; minimum: 16. Cost: \$270 (2B, 2L, 2D, R, 3ON, vans).

New England surficial geology is much more than glacial sediments; the past 12,000 years of hillslope and fluvial history are preserved in alluvial fans, lakes, and river terraces. We will examine numerous trenches, visit an active alluvial fan, evaluate evidence used to argue for post-Laurentide alpine glaciation in New



Manitoulin Isle,
Sudbury Area
—Photo by Chris
Fratton

England, and explore the effect of mountainous terrain on deglaciation. We will see the results of historic rock falls and debris avalanches as well as the dramatic geologic effects of historic clear cutting. The trip will have a strong hands-on component, including the use of real-time, centimeter-scale GPS and an evening of core logging and isotopic analysis.

4. ■ ALLOCYCLIC CONTROLS ON PALEOZOIC SEDIMENTATION IN THE APPALACHIAN BASIN

Friday, October 23 through Sunday, October 25. Cosponsored by *GSA Coal Geology Division*. C. Blaine Cecil, U.S. Geological Survey, Reston, VA 20192; (703) 648-6415, fax 703-648-6419, bcecil@usgs.gov; Frank Dulong and Bob Milici. This trip originates in Herndon, VA, near Washington D.C.'s Dulles International Airport and ends at the Pittsburgh International Airport, Pittsburgh, Pennsylvania. Maximum: 40; minimum: 25. Cost: \$260.00 (2L, R, 2ON, vans).

This trip will examine evidence for allocyclic controls on Paleozoic sedimentation and stratigraphy along an east-west transect across the Appalachian Basin from Washington's Dulles International Airport in northern Virginia to Pittsburgh International Airport in western Pennsylvania. Emphasis will be on variation in sediment supply as a function of long- to short-term paleoclimatic change. Relationships of climatic change to tectonic and eustatic processes will be discussed. Day one will include stops in strata that range in age from the Precambrian-Cambrian unconformity (a type one sequence boundary), to the Triassic in the Culpeper rift basin. Cambro-Ordovician and Silurian stops will include strata that formed in response to Early Paleozoic aridity. Devonian and Mississippian stops will illustrate evidence for climatic controls on the origin of petroleum source rocks and reservoirs. The onset of the breakup of Pangea and Triassic rifting and climatically-controlled rift basin cyclic sedimentation will also be illustrated during day one. Day two will

illustrate climatic controls on Mississippian, Pennsylvanian, and Permian (?) sediment supply, and tectonic and eustatic controls on accommodation space. Factors that influenced the deposition of essentially coal-barren strata (Mississippian) and coal-rich strata (Pennsylvanian) will be a primary topic of discussion. The cyclic nature of Middle and Late Pennsylvanian coal occurrence, and the factors that influenced this cyclicality, will also be illustrated and discussed on day two.

5. ■ FENITES, CARBONATITES, AND OTHER ALKALIC ROCKS IN THE BANCROFT-HALIBURTON-MUSKOKA REGIONS, GRENVILLE PROVINCE, ONTARIO

Friday, October 23 through Sunday, October 25. Sid B. Lumbers, 7 Calle Alejandra, Santa Fe, NM 87505, (505) 466-1233, fax 505-466-1236; Vince Vertolli. Maximum: 22; minimum: 13. Cost: \$260 (2B, 3L, 2D, R, 2ON, vans).

This trip will concentrate upon (1) the world-famous nepheline syenites and associated alkalic rocks well developed along the northern part of the Central Metasedimentary Belt between the towns of Bancroft and Haliburton, (2) an extensive zone of much younger fenitization and carbonatite emplacement that happens to coincide with the nepheline syenite suite, and (3) a second zone of fenite and carbonatite near Gravenhurst in the Central Gneiss Belt. The nepheline syenite suite has been studied over the past 100 years. The fenite-carbonatite suite was discovered and mapped only recently; it hosts most of the mineralization for which the Bancroft region is famous.

6. ■ STRATIGRAPHY, SEDIMENTOLOGY, AND PALEOCOMMUNITIES OF THE BLACK RIVER AND TRENTON LIMESTONE GROUPS (ORDOVICIAN), EAST OF LAKE SIMCOE, ONTARIO

Friday, October 23 through Sunday, October 25. Mike Brookfield, Dept. of Land Resource Science, University of Guelph, Guelph, ON,

N1G 2W1, Canada, (519) 824-4120, ext. 2654, fax 519-824-5730, mbrookfi@lrs.uoguelph.ca; El Gadi, Derek Armstrong, Dave Rudkin, and Carl Brett. Maximum: 28; minimum: 10. Cost: \$210 (3L, R, 2ON, vans).

The stratigraphy and paleontology of Ordovician strata of southern Ontario are features of this trip, which will cover the entire Black River-Trenton Limestone section and perhaps transition into black shales. We will examine vertical and lateral variations and problems of stratigraphic correlation; sedimentology—storm sedimentation, cycles, hardgrounds, cold water; paleocommunities—concentrating on well-exposed hardground communities, but also considering diverse soft-bottom communities, including ecological successions on shell-beds.

7. ■ HYDROGEOLOGY OF THE NIAGARA FALLS AREA

Saturday, October 24. Cosponsored by *GSA Engineering Geology Division* and *GSA Hydrogeology Division*. Kent S. Novakowski, Canada National Water Research Institute, CCIW, Environment Canada, 867 Lakeshore Rd., P.O. Box 5050, Burlington, ON, L7R 4A6, Canada, (905) 336-4610, fax 905-336-4972, Kent.Novakowski@cciw.ca; P. Lapcevic. Maximum: 45; minimum: 27. Cost: \$70 (1L, R, bus).

This field trip will provide the participant with a detailed view of the hydrostratigraphy and contaminant hydrogeology of the Silurian rocks of the Niagara region. The first stop will be a visit to the Niagara Gorge at the Sir Adam Beck power plant where the hydrostratigraphy of the Clinton and Cataract groups will be described first hand. The events which led to the contamination of the infamous "Bloody Run Creek" on the opposite (U.S.) side of the gorge will also be discussed. Following lunch at Table Rock Restaurant and some time to view Niagara Falls, we will proceed to the Smithville PCB site. At this stop, a detailed hydrogeological investigation of contaminant migration in the highly fractured Lockport formation will be discussed. One or two demonstrations of hydraulic testing and/or tracer testing will also be presented. The final stop on the itinerary will be a visit to the Cave Spring Winery on our return to Toronto.

8. ■ CLASSIC QUATERNARY GEOLOGY SITES OF TORONTO

Sunday, October 25 (repeated Friday October 30). Nick Eyles, Physical Sciences Division, Scarborough College, University of Toronto, 1265 Military Trail, Toronto, ON, M1C 1A4, Canada, (416) 287-7231, fax 416-287-7204, eyles@lake.scar.utoronto.ca. Maximum: 93; minimum: 30. Cost: \$45 (R, bus).

This one-day trip will visit classic interglacial and late glacial sites such as the Don Valley Brick Works, made famous by A. P. Coleman, and Scarborough Bluffs. We will see an almost complete succession from the last interglacial through the Wisconsin maximum.

9. ■ NIAGARA FALLS

Sunday, October 25. Cosponsored by *GSA History of Geology Division*. Keith Tinkler, Dept. of Geography, Brock University, St. Catharines, ON, L2S 3A1, Canada, (905) 688-5550, ext. 3486, fax 905-688-6369, ktinkler@spartan.ac.brocku.



Horseshoe Falls, Niagara Falls —Photo by E. B. Freeman

ca; Gerard Middleton. Maximum: 53; minimum: 35. Cost: \$55 (1L, R, bus).

This day-long return trip to Niagara from Toronto will include a river's edge walk from the Whirlpool to Niagara Glen. The intent is to give an overview of changing geological and geomorphological perspectives concerning a single well-defined landform assemblage during the course of three centuries. The interpretation of the fluvial history of the Niagara Gorge has been of interest since shortly after European travelers first saw it in 1678. An accurate height was obtained in 1721 and by mid-century quite accurate descriptions had been made of the gorge by travelers. In the 1760s Pouchot made some insightful remarks about the recession of the waterfall, its contribution to the excavation of the gorge, and its possible steady recession from Lewiston. By late in the 18th century the rate of recession and whether the gorge had receded from Lewiston-Queenston and might be used to date the age of Earth were being debated. By the 1830s and 1840s fuller descriptions were given by Bakewell, Hall, and Lyell within the context of a developing science of geology. Definitive accounts by Hall and Lyell in the professional literature closed this period of discussion. Late in the century, renewed discussion concerned the gorge's relation to the routes and quantities of discharge from the upper Great Lakes after the recession of the ice sheet, the rate of recession as estimated from repeated surveys, and highly variable estimates of the duration of the postglacial period using the recession of the waterfall as a gauge. Definitive accounts by Spencer, Gilbert, and Kindle and Taylor early in the 19th century concluded what may be termed the classic phase of investigation at Niagara. A refined understanding of postglacial time, postglacial water level and discharge routing histories of the Great Lakes, and improved dating methods for shells have led to further study.

POSTMEETING TRIPS

10. ■ CLASSIC QUATERNARY GEOLOGY SITES OF TORONTO

Friday, October 30 (repeated Sunday, October 25). Nick Eyles, Physical Sciences Division, Scarborough College, University of Toronto, 1265 Military Trail, Toronto, ON, M1C 1A4, Canada, (416) 287-7231, fax 416-287-7204, eyles@lake.scar.utoronto.ca. Maximum: 93; minimum: 30. Cost: \$45 (R, bus).

This one-day trip will visit classic interglacial and late glacial sites such as the Don Valley Brick Works, made famous by A. P. Coleman, and Scarborough Bluffs. We will see an almost complete succession from the last interglacial through the Wisconsin maximum.

11. ■ GROUNDWATER EXPERIMENTAL FIELD STATION AT CANADA FORCES BASE BORDEN: OVERVIEW OF PAST AND PRESENT RESEARCH ACTIVITIES

Friday, October 30. Cosponsored by *GSA Engineering Geology Division* and *GSA Hydrogeology Division*. Dave Rudolph, Dept. of Earth Sciences, University of Waterloo, Waterloo, ON, N2L 3G1, Canada, (519) 888-4567, ext. 6778, fax 519-746-5644, drudolph@sciborg.uwaterloo.ca; John A. Cherry. Maximum: 40; minimum: 15. Cost: \$60 (R, vans).

This trip will leave Toronto and cross over the western end of the Oak Ridges Moraine en route to Canada Forces Base Borden. The Base has been the location of extensive field studies in physical and contaminant hydrogeology. Over the past two decades, experiments focused on the fate and transport characteristics of many different contaminant species have been carried out at the site under the primary direction of researchers from the University of Waterloo. The site has also been employed for the development and field testing of groundwater monitoring devices used in standard and expedited site characterization. An overview lecture on the research history at the site will be followed by a brief description of the geologic setting of the area. A driving and walking tour of the site that will include stops at five or six active experimental sites will follow. Personnel responsible for the research will be available at each site to provide explanations and to lead discussions. Several of the newly emerging technologies will be demonstrated in the field. A detailed bibliography of all the research work carried out at the Base Borden site will be provided in the field trip guide.

12. ■ CHERT, CORN, ENVIRONMENTAL CHANGE AND PREHISTORIC LAND CLEARANCE: THREE GEOARCHAEOLOGICAL STUDIES ON THE NIAGARA ESCARPMENT

Friday, October 30 and Saturday, October 31. Cosponsored by *GSA Archaeological Geology Division*. Ronald F. Williamson, Archaeological Services Inc., 528 Bathurst Street, Toronto, ON, M5S 2P9, Canada, (416) 966-1069, fax 416-966-9723, archaeology@sympatico.ca; Peter L. Storck and Robert I. MacDonald. Maximum: 44; minimum: 30. Cost: \$135 (1L, R, 1ON, bus).

The vertical cliffs of the Niagara escarpment stand out as one of the most dramatic landscape features in southern Ontario. This field trip will visit three archaeological sites on the escarpment that have offered unique insights into the prehistory of southern Ontario. First stop will be the Peace Bridge site in Fort Erie, an extensive workshop, habitation, and cemetery site associated with prehistoric quarrying at a major outcrop of Onondaga Formation chert. The site spans 4,000 years of occupation beginning in the late Archaic period, as changing water levels in the Lake Erie basin prior to this time appear to have restricted access to the chert deposits. Visits to both the site and quarry will include discussion of the archaeological and geological history of the area. On Friday afternoon, participants will visit varved Crawford Lake, near the edge of the Niagara Escarpment west of Toronto. Coring of the lake bottom sediments in the early 1970s revealed corn pollen at levels dating to between the 14th and 16th centuries A.D.; thus, one or more Iroquoian villages and their associated agricultural fields were likely in the neighborhood. Subsequent archaeological survey and excavations have provided a wealth of information concerning Iroquoian settlement in the region, and its effects upon the local environment. The visit to Crawford Lake will also include a tour of a reconstructed Iroquoian village. On Saturday, participants will travel to the Red Wing site, an early Paleo-Indian occupation located near the source of the Fossil Hill Formation chert, the preferred toolstone of the earliest, highly mobile colonists of southern Ontario. The site is the subject of an ongoing multidisciplinary

study involving geological, paleobiological and archaeological specialists, who will be on hand to discuss their research into the environmental setting of the site, the changes it underwent, and the lives of its occupants.

13. ■ HYDROGEOLOGY AND LATE QUATERNARY HISTORY OF POINT PEELE NATIONAL PARK, ONTARIO

Friday, October 30 and Saturday, October 31. Cosponsored by *GSA Engineering Geology Division*. Allan Crowe, Canada National Water Research Institute, CCIW, Environment Canada, 867 Lakeshore Rd., P.O. Box 5050, Burlington, ON, L7R 4A6, Canada, (905) 336-4585, fax 905-336-4400, Allan.Crowe@CCIW.ca; John Coakley, C. J. Ptacek. Maximum: 44; minimum: 30. Cost: \$165 (2L, R, 1ON, bus).

Point Pelee National Park occupies the southernmost 9 km of a cusped foreland that extends 15 km into Lake Erie; 70% of the park consists of marsh. Although Point Pelee is Canada's smallest national park, it is internationally known as a world-class bird-watching site and monarch butterfly migratory resting site. Recent studies to characterize the groundwater flow regime had the objective of assessing the potential transport and impact of septic-system-derived nutrients on the marsh. The extensive drilling program yielded considerable subsurface data used to interpret the nature and lateral geometry of sedimentary units below the Point Pelee foreland, as well as the postglacial history of the western basin of Lake Erie. The field trip will highlight (1) the complex groundwater flow regime, which exhibits a 180° reversal in the direction of flow; (2) its impact on contaminant transport to the marsh, or lack of it; and (3) the four major sedimentary units identified: a basal clay-rich till, a fine-grained glaciolacustrine sand, a medium-grained sand unit (subdivided into a poorly sorted shoreface sand and an aeolian sand derived from the shoreface sand), and an organic marsh (gyttja) deposit. On route to Point Pelee there will be short visits to the other two major cusped forelands on the north shore of Lake Erie: Pointe-aux-Pins and Long Point.

14. ■ LATE GRENVILLIAN HORIZONTAL EXTENSION AND VERTICAL THINNING OF PROTEROZOIC GNEISSES, CENTRAL ONTARIO

Friday, October 30 and Saturday, October 31. Cosponsored by *GSA Structural Geology and Tectonics Division*. Walfried M. Schwerdtner, Dept. of Geology, University of Toronto, Toronto, ON, M5S 3B1, Canada, (416) 978-2062, fax 416-978-3938, fried@quartz.geology.utoronto.ca; Dennis H. Waddington and Vince Vertolli. Maximum: 33; minimum: 15. Cost: \$160 (2L, R, 1ON, vans).

This 36-hour visit to the Parry Sound-Muskoka district has two objectives: (1) to view evidence for gravitational orogenic collapse and widespread deep-crustal melting in parts of the Central Gneiss Belt, and (2) to illustrate the relationship between magnitude of horizontal extension and/or vertical thinning of ductile rock masses and strain components measured in the field. Rock exposures, generally located along fresh road cuts and/or along scenic shores of lakes and rivers, are magnificent. The Parry Sound-Muskoka segment of the Central Gneiss Belt is widely regarded as a collage of structural domains representing the Grenvillian parautochthon and several alloch-

Whitefish Falls
Field Camp,
Manitoulin Isle,
Sudbury Area
— Courtesy of
University
of Toronto,
Dept. of Geology.



thons. We will inspect large outcrops in the allochthonous Parry Sound, Moon River, and Muskoka domains, as well as a few exposures in the parautochthonous Rosseau domain. Many outcrops in the Parry Sound–Muskoka district exhibit a large variety of structural features. Spectacular contractional features such as tight S-Z folds are widespread and difficult to ignore, but we will focus attention on superimposed extensional features such as pegmatite dikes, quartz-filled extension fractures (veinlets), foliation boudins, and stretched pseudomorphs after garnet. Individual features attest to a few percent to tens of percent extension, on the kilometre scale, but their common superposition produces net amounts locally exceeding 100%.

15. ■ REGIONAL QUATERNARY GEOLOGY AND HYDROGEOLOGY OF THE OAK RIDGES MORaine AND GREATER TORONTO AREAS, SOUTHERN ONTARIO

Friday, October 30 and Saturday, October 31. Cosponsored by *GSA Quaternary Geology and Geomorphology Division*. David Sharpe, Geological Survey of Canada, 601 Booth St., Ottawa, ON, K1A 0E8, Canada, (613) 992-3059, fax 613-992-0190, sharpe@NRCan.gc.ca; P. Barnett, H. Russell, L. Dyke, M. Hinton, R. Gerber, and T. Brennand. This trip begins and ends each day in Toronto. Maximum: 33; minimum: 16. Cost: \$115 (2L, R, vans).

The Oak Ridges moraine, an aquifer complex of national significance, is the focus of a multidisciplinary study by the Geological Survey of Canada (GSC), the Ontario Geological Survey, and other groups under the GSC's NATMAP (National Mapping) and hydrogeology programs. The research group, which has just completed mapping the thick sediment cover in the area in three dimensions, will display a set of new regional maps. Recent research is highlighted by advances in understanding the regional geology—deep channel structures (50 line km of new seismic reflection data) and their role in establishing the hydrostratigraphy of the area. Water resources, especially groundwater, are under stress because of rapid and continued urbanization. Issues of water supply, water quality, watershed planning, cold-water fishery, and competing land uses—e.g., landfills, golf courses, and aggregate extraction—have emerged. The field trip will highlight the

new work by developing concepts concerning regional geologic architecture and areas of advancement in hydrogeologic understanding. Particular emphasis will be directed toward water-supply issues. The trip will be preceded by an orientation meeting, on the previous evening, that will include a trip overview, regional concepts, a review of the Oak Ridges moraine database, and a GIS–remote-sensing presentation. The trip highlights a 192-m-deep, continuous core to the base of the Laurentian channel, a complex, deep regional channel network and the results of a regional, sub-watershed-scale stream-gauging program. For more information on this area, visit the Oak Ridges moraine Web site: <http://sts.gsc.nrcan.gc.ca/page1/environ/orm/orm.htm>.

16. ■ SILURIAN-DEVONIAN STRATIGRAPHY OF THE NIAGARA ESCARPMENT

Friday, October 30 and Saturday, October 31. Carlton Brett, Dept. of Earth and Environmental Sciences, University of Rochester, Rochester, NY 14627, (716) 275-2408, fax 716-244-5689, cebh@db1.cc.rochester.edu; Brian Pratt. Maximum: 28; minimum: 18. Cost: \$160 (1B, 2L, R, 1ON, vans).

This trip will examine selected localities in the classic Upper Ordovician, Silurian, and Middle Devonian strata along and near the Niagara escarpment, from Niagara Falls and western New York State north to the Bruce Peninsula of southern Ontario. These outcrops include some of the most famous Paleozoic rocks in eastern North America, and they have recently provided numerous insights into sea-level and tectonic history of the Appalachian foreland basin and the adjacent Algonquin arch. These sediments are also the outcrop equivalents of hydrocarbon-bearing strata in the Michigan Basin subsurface. The trip will emphasize sequence, cycle, and event stratigraphy and foreland basin–arch dynamics. Recent studies have delineated a series of depositional sequences and smaller scale cycles, and this framework has permitted recognition of a cycle of eastward and then westward migration of the foreland basin–arch couple. Silurian strata are highly fossiliferous and include some spectacular examples of smothered bottom assemblages and even soft-bodied fossils. Representatives of many distinctive benthic fossil assemblages include corals, stromatoporoids,

brachiopods, bryozoans, trilobites, mollusks, and echinoderms. Geologic-paleontologic features to be seen include: (1) regionally angular unconformities (sequence boundaries), and condensed phosphatic beds (flooding surfaces), (2) Upper Ordovician and Lower Silurian fluvial and deltaic facies, (3) mixed siliciclastic-carbonate sequences in the fossiliferous Clinton Group (mid-Silurian), (4) probable seismites (widespread intervals of extensive soft-sediment deformation), (5) high-energy crinoidal grainstone shoals, (6) tabulate-stromatoporoid patch reefs and laterally adjacent lower energy “inter-reef” dolostone facies, (7) an Upper Silurian soft-bodied fossil locality, (8) stromatolitic and evaporite-bearing Upper Silurian sequences, (9) eurypterid-bearing dolostones of the Bertie Group, and (10) the Silurian-Devonian (Wallbridge) karstic unconformity, overlain by Middle Devonian reefy carbonates.

STUDENTS: The *GSA Structural Geology and Tectonics Division* offers five \$100 scholarships to division-affiliated student members for division-sponsored field trips (1, 2, 14). Apply in writing, giving name, institution, class, specialty, poster or talk title, field trip title, and a one-paragraph rationale, to Vicki Hansen. Applications accepted by e-mail (vhansen@mail.edu.smu) or fax (214-768-2701) from September 7 through September 11, 1998. See the Structural Geology and Tectonics Division newsletter for more information.

**SPONSORED BY SOCIETY OF ECONOMIC GEOLOGISTS
GOLD DEPOSITS OF NORTHERN SONORA, MEXICO**

Monday, October 19 through Saturday, October 24. Kenneth F. Clark, Dept. of Geological Sciences, University of Texas at El Paso, El Paso, TX 79968-0555, (915) 747-5843, fax 915-747-5073, clark@geo.utep.edu. This trip begins and ends in Tucson, Arizona.

This six-day trip will feature the newly discovered, disseminated gold deposits along the general northwest trend between Santa Ana and Sonoyta—the so-called Altar Gold Belt—and selected other gold deposits in northwestern Sonora. Gold deposits to be visited include, among others, Santa Gertrudis (Campbell Resources), San Francisco (Geomaque), Cerro Colorado (Laramide), La Herradura (Peñoles-Newmont), and La Choya (Hecla). Gold mineralization in these deposits occurs in a variety of host rocks ranging in age from Precambrian to Holocene. The deposits are broadly coincident with the postulated trace of the Mojave-Sonora megashear, a core complex, and other controlling structures.

Limit: 45. Cost: \$670, includes field trip transportation, all meals, accommodations (double occupancy), and guidebook. Preregistration required. Send check, payable to Society of Economic Geologists, 5808 South Rapp Street, Suite 209, Littleton, CO 80120; (303) 797-0332, fax 303-797-0417. Major credit cards also accepted.



PREREGISTRATION DEADLINE— SEPTEMBER 18

GSA-SPONSORED SHORT COURSES

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

A course-only fee of \$35 is required if you are not attending the meeting. This fee may be applied to a full meeting registration if you decide to attend. Preregistration is

recommended; on-site registration is \$30 additional. You may register for GSA courses on the Annual Meeting Preregistration Form.

**FEES ARE GIVEN
IN U.S. DOLLARS**



**Continuing
Education Unit
(CEU) Service**

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

Cancellation Deadline: September 25

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

1. ■ ANALYSIS OF VEINS IN LOW-TEMPERATURE ENVIRONMENTS—INTRODUCTION FOR STRUCTURAL GEOLOGISTS

Saturday, October 24 and Sunday, October 25, 8:00 a.m. to 5:00 p.m. Metro Toronto Convention Centre. Cosponsored by *GSA Structural Geology and Tectonics Division*.

STUDENTS: The *GSA Structural Geology and Tectonics Division* offers five \$100 scholarships to division-affiliated student members for division-sponsored short courses. Apply in writing, giving name, institution, class, specialty, short-course title, and a one-paragraph rationale, to Vicki Hansen by e-mail (vhansen@mail.edu.smu) or fax (214-768-2701) from September 7 through September 11, 1998. See the *Structural Geology and Tectonics Division* newsletter for more information.

This course will introduce the participants to the integration of geochemical, fabric, and fluid-inclusion data in interpreting the formation and significance of veins. The format will be lectures, case histories, and exercises. Topics covered include: Overview of vein research; hydrology of veins; subsurface fluids and pre-

cipitation kinetics; applications of isotopes to veins; problems and potential of fluid inclusions in veins; case histories of the application of structural geology and geochemistry to understanding fluid composition; temperature and pressure during tectonism.

WHO SHOULD ATTEND

Those who have little background in geochemistry but have an interest in unraveling the fluid sources, conditions of formation, and tectonic significance of veins.

RECOMMENDED BACKGROUND

One year of college chemistry and a first course in geochemistry are highly recommended.

WHAT YOU WILL LEARN

An appreciation for the complexities of chemical mass transport in vein formation; the interplay of mechanics, kinematics, and geochemistry of veining; case histories of vein filling and fabrics; and estimates of fluid composition, pressure, and temperature during deformation.

FACULTY: David V. Wiltschko, Dept. of Geology and Geophysics, Texas A&M University, College Station; Ph.D., Brown University; John W. Morse, Dept. of Geology and Geophysics, Texas A&M University, College Station; Ph.D., Yale University; Zachary D. Sharp, Dept. of Earth and Planetary Sciences, University of New Mexico; Ph.D., University of Michigan; Will Lamb, Dept. of Geology and Geophysics, Texas A&M University, College Station; Ph.D., University of Wisconsin, Madison.

Limit: 40. Fee: \$290, students \$270; includes course manual and lunch both days. CEUs: 1.6.

2. ■ DEFORMATION MECHANISMS AND MICROSTRUCTURES

Saturday, October 24, 8:00 a.m. to 5:00 p.m., and Sunday, October 25, 8:00 a.m. to 12:00 noon. University of Toronto. Cosponsored by *GSA Structural Geology and Tectonics Division*.

STUDENTS: The *GSA Structural Geology and Tectonics Division* offers five \$100 scholarships to division-affiliated student members for division-sponsored short courses. Apply in writing, giving name, institution, class, specialty, poster or talk title, short-course title, and a one-paragraph rationale, to Vicki Hansen by e-mail (vhansen@mail.edu.smu) or fax (214-768-2701) from September 7 through September 11, 1998. See the *Structural Geology and Tectonics* newsletter for more information.

This is an introductory-level course dealing with grain-scale deformation mechanisms and microstructures. Lectures illustrated with slides will cover the deformation mechanisms of brittle faulting, cataclastic flow, semi-brittle flow, dislocation creep, pressure solution, and grain-size sensitive creep, as well as the interactions of deformation and metamorphism. Laboratory session with hand samples and thin sections of experimentally and naturally deformed rocks will allow for practical experience and discussion. The course will illustrate how microstructural studies can contribute to a better understanding of lithospheric deformation, including the brittle-ductile transition, the strength profile and strain partitioning, the effects of partial melt, and seismic anisotropy.

WHO SHOULD ATTEND

Earth scientists with no previous experience with deformation mechanisms, but wishing to teach about them or incorporate them into their research.

RECOMMENDED BACKGROUND

General knowledge of structural geology and familiarity with studying rocks in thin section using a petrographic microscope.

WHAT YOU WILL LEARN

How to recognize the operation of various grain-scale deformation mechanisms from a combination of hand-sample and thin-section scale observations; what one can infer from such observations about the deformation conditions and rock rheology, and possible influence of phase changes.

FACULTY: Jan Tullis, Dept. of Geological Sciences, Brown University; Ph.D., University of California, Los Angeles; Christian Teyssier, Dept. of Geology, University of Minnesota; Ph.D., Monash University, Australia; Holger Stunitz, Geology and Paleontology Institute of Basel University, Switzerland; Ph.D., ETH Zurich.

Limit: 30. Fee: \$250, students \$230; includes course manual, slide set, and lunch on Saturday. CEUs: 1.6.

3. ■ PHASE I ENVIRONMENTAL SITE ASSESSMENTS

Saturday, October 24 and Sunday, October 25, 8:00 a.m. to 5:00 p.m. Metro Toronto Convention Centre. Cosponsored by *GSA Engineering Geology Division*.

STUDENTS: The *GSA Engineering Geology Division* will subsidize the first five student registrants who are valid division members. Students *must pay the full course fee* when registering, but will be reimbursed \$50 after the GSA meeting by the Engineering Geology Division.

This course will present an overview of all aspects of performing a Phase I Environmental Site Assessment, including the purposes and objectives of the investigation, a discussion of all appropriate environmental regulations, appropriate sources of information, how to conduct the assessment, and environmental liability. We will review the regulatory basis for the assessments and cover the resources available to assist in the performance of the assessments. Optional exam—This course is endorsed by the National Registry of Environmental Professionals (NREP) and will offer the NREP exam. A passing grade on this exam, together with a college degree and professional experience, will qualify you for the title of Registered Environmental Property Assessor (REPA). Credentials such as these are needed to perform Phase I assessments in some states. Attendees not having the educational or professional requirements needed for the REPA designation may be certified as Associate Environmental Property Assessors until the additional requirements are fulfilled.

WHO SHOULD ATTEND

Geoscientists (students to professionals) who are involved or interested in Phase I Environmental Assessments. This is a growing area for professional geologists and should

prove to be an important topic for both students and teachers. This course will serve as a review prior to the certification exam for more experienced professionals, and at the same time will provide detailed information for those less experienced.

RECOMMENDED BACKGROUND

Attendees should have a basic knowledge of environmental regulations. Some experience in performing environmental or geologic assessments would also be helpful, but it is not required.

WHAT YOU WILL LEARN

Attendees will learn how to perform a Phase I Environmental Assessment based on NREP and ASTM standards, where to obtain the data needed to perform an assessment, and how to interpret those data.

FACULTY: Raymond C. Kimbrough, Tom Joiner & Associates, Inc., Tuscaloosa; B.A., University of Alabama.

Limit: 30. Fee: \$245, students \$225; includes course manual and lunch both days. CEUs: 1.6. *Optional exam fee: \$90. Optional NREP Study Guide is available for \$50.*

4. ■ THREE-DIMENSIONAL SEISMIC INTERPRETATION: A PRIMER FOR GEOLOGISTS

Saturday, October 24 and Sunday, October 25, 8:00 a.m. to 5:00 p.m. Metro Toronto Convention Centre.

This is an introductory-level class aimed at introducing the theory and application of three-dimensional seismic technology to geologists. This technology has become a mainstay of a reinvigorated petroleum exploration and development industry, and applications in other academic and applied branches of the geosciences are being developed (e.g., mining, environmental geology, structural geology, and stratigraphy). As these applications become more widespread, increasing numbers of geologists, many with little or no formal geophysics training, will be exposed to results that are based on interpretations of 3-D seismic data. There are few, if any, opportunities for these geologists to become acquainted with the technology at an appropriate level. This course is designed to fill that gap, and will emphasize the qualitative, rather than quantitative, aspects of seismic technology.

WHO SHOULD ATTEND

Geologists in a variety of geoscience subdisciplines (e.g., structural geology and tectonics, sedimentary geology, mining, petroleum and environmental geology, geophysics).

RECOMMENDED BACKGROUND

Attendees will be expected to have an understanding of basic stratigraphic and structural principles. There are no rigorous mathematics prerequisites.

WHAT YOU WILL LEARN

Upon completion of this course, participants will be familiar with the terminology, techniques, and potential benefits and pitfalls of exploiting 3-D seismic data and will be able to make more competent judgments concerning the utilization of the technology.

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

Limit: 40. Fee: \$240, students \$220; includes course manual and lunch both days. CEUs: 1.6.

5. ■ ANALYTICAL METHODS AND APPLICATIONS IN PROVENANCE STUDIES OF LITHIC ARTIFACTS

Sunday, October 25, 8:00 a.m. to 5:00 p.m. University of Toronto. Cosponsored by GSA Archaeological Geology Division.

Introduction to the use of geological and geochemical techniques to positively identify quartz-rich lithic artifacts using both destructive and nondestructive techniques, including petrography and cathodoluminescence characteristics of cherts and sandstones; X-ray fluorescence; instrumental neutron activation analysis, using the SLOWPOKE reactor at the University of Toronto; ICP-MS and other methods of chemical analysis. Where possible, examples will be used from ongoing studies, aimed at delimiting archaeological trade, migration, and exchange patterns.

WHO SHOULD ATTEND

Geologists and archaeologists who wish to develop a comprehensive understanding of the limitations, perils, and advantages of using both destructive and nondestructive geological and geochemical techniques to identify quartz-rich lithic artifacts.

RECOMMENDED BACKGROUND

Wide open.

WHAT YOU WILL LEARN

Participants will learn how to do lithic analysis at the least cost and greatest level of confidence; variability of source materials; and nomenclature differences between geologists and archaeologists. Discussion will focus on sample preparation, size, and limitations of methodology and cultural applications.

FACULTY: Patrick J. Julig, Dept. of Sociology and Anthropology, Laurentian University, Sudbury, Ontario; Ph.D., University of Toronto; Darrel G. F. Long, Dept. of Earth Sciences, Laurentian University, Sudbury, Ontario; Ph.D., University of Western Ontario; R. G. V. Hancock, SLOWPOKE reactor facility, Dept. of Chemical Engineering and Applied Chemistry, University of Toronto; Ph.D., McMaster University, Hamilton, Ontario.

Limit: 30. Fee: \$220, students \$200; includes course manual and lunch. CEUs: 0.8.

6. ■ APPLICATIONS OF ENVIRONMENTAL ISOTOPES IN GROUNDWATER STUDIES

Sunday, October 25, 8:00 a.m. to 5:00 p.m. Metro Toronto Convention Centre. Cosponsored by GSA Hydrogeology Division.

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

This course aims to provide the basic knowledge that is required to apply environmental isotopes in groundwater problems. The course will be focused mainly on key issues that have relevance for groundwater evaluation and groundwater management. These include origin and residence time of groundwater, groundwater-surface-water interaction, and groundwater contamination due to agriculture and urban activities. The case studies will be used to emphasize the methodology that is required to apply isotope tracers in groundwater and discuss the advantages and limitations of these techniques.

WHO SHOULD ATTEND

Students, professors, government scientists, and environmental consultants working in the area of evaluation of groundwater resources and groundwater management.

RECOMMENDED BACKGROUND

Those with a senior undergraduate or graduate background in physical science who wish to apply isotope techniques in groundwater studies.

WHAT YOU WILL LEARN

This course will focus on practical application of environmental isotopes in groundwater; therefore, the participants will be taught a practical approach, depending on the question under investigation, that is required for the application of environmental isotopes in groundwater studies.

FACULTY: Ramon Aravena, Dept. of Earth Sciences, University of Waterloo, Ontario; Ph.D., University of Waterloo; Ian D. Clark, Dept. of Geology, University of Ottawa; Ph.D., Université de Paris-Sud, Orsay, France.

Limit: 50. Fee: \$190, students \$170; includes course manual and lunch. CEUs: 0.8.



Solution joints in Bobcaygeon Fm. limestone (Blackriverian age) near Madoc, Ontario
—Photo by E. B. Freeman

7. ■ BUCK ROGERS, FIELD GEOLOGIST: 21ST CENTURY ELECTRONIC WIZARDRY FOR MAPPING AND FIELD DATA COLLECTION

Sunday, October 25, 8:00 a.m. to 5:00 p.m.
Metro Toronto Convention Centre.

This course will bring participants up to speed on the latest electronic tools for field mapping and data acquisition and management. Participants will become familiar with hardware and software advances for computerized field mapping, proposed standard data models for the representation of geologic map information in a geographic information system (GIS), and implications of those models for data collection. Hardware described or displayed will include rugged pen computers used as electronic plane tables, laser range-finder binoculars, hand-held Global Positioning System (GPS) receivers, and digital cameras. Software will include PC-based data mapping and geographic information systems used by USGS and other workers.

WHO SHOULD ATTEND

Field geologists, researchers, exploration managers, and teachers.

RECOMMENDED BACKGROUND

Familiarity with computerized "desktop" user interfaces (MAC, Windows). Knowledge of traditional geologic mapping data and techniques.

WHAT YOU WILL LEARN

Participants will come away with a knowledge of the most sophisticated hardware and software currently available for data collection and mapping and will have had hands-on experience with computerized mapping and field data input systems. Participants will be better able to decide if they should "go digital" in their field mapping, and will know how to proceed if the answer is "yes."

FACULTY: John H. Kramer, Senior Hydrogeologist, Condor Earth Technologies, Inc., Sonoma, California; Ph.D., University of California, Santa Barbara; Todd T. Fitzgibbon, U.S. Geological Survey, Menlo Park, California; BA, University of California, Santa Barbara.

Limit: 35. Fee: \$240, students \$220; includes course manual and lunch. CEUs: 0.8.

8. ■ DESIGN AND CREATION OF STATE-OF-THE-ART, INTERACTIVE, MULTIMEDIA CD-ROMS FOR USE IN TEACHING GEOLOGY

Sunday, October 25, 8:00 a.m. to 5:00 p.m.
University of Toronto.

In recent years, there has been a growing concern regarding the academic performance by non-science majors in U.S. colleges and universities who have had to take a limited number of science courses to meet their graduation requirements. Although the reasons for such a trend are likely diverse, one way to enhance students' interest in science courses (including geoscience courses) is by teaching them in a multimedia format. Effective instruction must take into account the dominant mode of information transfer that is used by the present generation of students. Students today are bombarded incessantly by the media with information that is a mixture of audio, video, and text data, at a very rapid rate of delivery. Therefore, it becomes imperative that we, as geoscience educators, utilize an analogous, parallel mechanism for information delivery, one that is heavily based on a mixture of audio,

video, and text, rather than predominantly text or a combination of text with either audio or video. In response to the call for rethinking the manner in which introductory geology is taught on U.S. campuses, Sethi developed this course for teaching the variety of issues involved in effective design and production of interactive, multimedia CD-ROMs for use in teaching geosciences.

WHO SHOULD ATTEND

Geoscience faculty, administrators, graduate students interested in pursuing careers in teaching, and individuals interested in instructional technology as it may relate to other disciplines.

RECOMMENDED BACKGROUND

Participants should have a basic understanding of word processing and using graphics programs such as PowerPoint in Windows 3.X, Windows 95, or Windows NT PC environments.

WHAT YOU WILL LEARN

Participants will learn how to create and use multimedia and instructional CD-ROMs to teach in a way that is engaging and interesting for even the most indifferent student, as well as educational principles, instructional design, and hardware and software issues involved in the designing and production of interactive, multimedia CD-ROMs for use in their own classrooms.

FACULTY: Parvinder S. Sethi, Dept. of Geology, Radford University, Radford, Virginia; Ph.D., North Carolina State University.

Limit: 25. Fee: \$230, students \$210; includes course manual and lunch. CEUs: 0.8.

9. ■ DETECTING ENVIRONMENTAL EFFECTS USING BENTHIC FORAMINIFERA AND THECAMOEBIANS

Sunday, October 25, 8:00 a.m. to 5:00 p.m.
Metro Toronto Convention Centre.
Cosponsored by *Cushman Foundation*.

This course will focus on foraminifera and thecamoebians as environmental tools for the interpretation of recent as well as ancient coastal and lacustrine environments. The session will provide fundamental background information on the ecology of the two microfossil groups and provide instruction as to proper collection, storage, and examination procedures. Use of case studies will emphasize the utility of these organisms in seismic risk assessment, paleoclimatology, sea-level, and geoarchaeology and as environmental indicators in pollution detection. The course will consist of morning lecture sessions followed by an afternoon practical session that will concentrate on "hands-on" microscope work and related discussion.

WHO SHOULD ATTEND

Upper-division undergraduate students, graduate students, professors, practicing earth scientists, and archaeologists. The course will be targeted toward the coastal or limnological researcher who is unfamiliar, or only vaguely familiar, with foraminifera and thecamoebians and their use as environmental indicators.

RECOMMENDED BACKGROUND

No prior experience with micropaleontology is required, although participants should have some knowledge of coastal or lacustrine systems.

WHAT YOU WILL LEARN

Participants will learn how to design a sampling strategy, how to recover, process, and examine microfossil samples, and how to interpret results. With this knowledge, participants will be able to incorporate micropaleontological methods into their own research design.

FACULTY: David B. Scott, Dept. of Earth Sciences, Dalhousie University, Halifax, Nova Scotia; Ph.D., Dalhousie University; Eduard G. Reinhardt, Dept. of Earth Sciences, Dalhousie University, Halifax, Nova Scotia; Ph.D., Carleton University, Ottawa, Ontario; Francine M. G. McCarthy, Dept. of Earth Sciences, Brock University, St. Catharines, Ontario; Ph.D., Dalhousie University, Halifax, Nova Scotia; R. Timothy Patterson, Dept. of Earth Sciences, Carleton University, Ottawa, Ontario; Ph.D., University of California, Los Angeles.

Limit: 30. Fee: \$230, students \$210; includes course manual and lunch. CEUs: 0.8.

10. ■ GEOTECHNICAL AND ENVIRONMENTAL APPLICATIONS OF TIME DOMAIN REFLECTOMETRY

Sunday, October 25, 8:00 a.m. to 5:00 p.m.
Metro Toronto Convention Centre.
Cosponsored by *GSA Engineering Geology Division*.

STUDENTS: The *GSA Engineering Geology Division* will subsidize the first five student registrants who are valid division members. Students *must pay the full course fee* when registering, but will be reimbursed \$50 after the GSA meeting by the Engineering Geology Division.

This course will provide participants with an introduction to use of time domain reflectometry (TDR) technology. This commercially available technology is being used to remotely and continuously monitor subsidence, slope stability (in both soil and rock), scour of bridge foundations, landfill cover performance, leak detection, contaminant transport, and fluid levels. Case histories and hands-on demonstrations are used to familiarize participants with the simplicity, robustness, and flexibility of TDR technology for each of these applications.

WHO SHOULD ATTEND

Geologists, engineering geologists, geotechnical engineers, environmental engineers, engineering technicians, university professors, students, and instrumentation manufacturers.

RECOMMENDED BACKGROUND

Experience with instrumentation, instrumentation programs, data acquisition, and data interpretation. The level of sophistication with respect to electronics will be very low. The physics involved will be explained during the lectures.

WHAT YOU WILL LEARN

Attendees will learn about diverse applications of TDR technology. Hands-on demonstrations include: monitoring deformation, monitoring fluid levels and conductivity within a monitoring well, monitoring soil moisture, and leak detection.

FACULTY: Kevin M. O'Connor, President, GeoTDR, Inc., Apple Valley, Minnesota; Ph.D., Northwestern University; Charles H. Dowding, Dept. of Civil Engineering, Northwestern University; Ph.D., University of Illinois at Urbana.

Limit: 50. Fee: \$190, students \$170; includes course manual and lunch. CEUs: 0.8.

11. ■ TEACHING PRACTICAL HYDROGEOLOGY: HOW TO MAKE DO WITH SCANT "REAL WORLD" DATA

Sunday, October 25, 8:00 a.m. to 5:00 p.m.
Metro Toronto Convention Centre.

Cosponsored by *GSA Hydrogeology Division*.

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

Much of what is taught in elementary hydrogeology courses and textbooks has minimal value when students enter the real world, particularly in consulting and regulatory employment. In practice, the types and quality of hydraulic, geologic, and chemical data are constrained by regulatory, legal, and economic considerations such that "textbook" methods may not be feasible. Hydrologic and chemical data are often scant, of poor quality, and incomplete. To do hydrogeology in practice, therefore, is less an academic exercise in technique, however mathematically sophisticated, than an exercise in clear critical thinking based upon first principles. This course is designed to guide college instructors to what are the practical essentials of hydrogeologic and pertinent geochemical analysis and how to apply them to solve real-world consulting (and arguable, academic) problems. The course will consist of materials presented in college-level (upper undergraduate–beginning graduate) hydrogeology courses coupled with case-study problems designed to illustrate methods of interpretation. Attendees will gain a clear understanding of the typical degree of precision and accuracy possible in typical hydrogeologic studies in practice, and the most appropriate means to extract the most reliable information from often marginal hydraulic and chemical data sets. The underlying premise of the course comes from Aristotle's admonition, "It is the mark of an instructed mind to rest satisfied with the degree of precision which the nature of the subject permits, and not to seek an exactness where only an approximation of the truth is possible."

WHO SHOULD ATTEND

College and university professors who are not formally trained in hydrogeology, (e.g., have not prepared a dissertation on the subject), but who are teaching the subject and/or who have minimal real-world consulting experience should find the nontraditional perspective of this course valuable.

RECOMMENDED BACKGROUND

Participants would have either taught or taken a course in hydrogeology or done hydrogeologic projects in the workplace. It will be assumed that everyone knows or has been exposed to Geology 101 material, Darcy's Law, and basic chemical nomenclature (symbols—not thermodynamics!).

WHAT YOU WILL LEARN

Attendees will learn to use Darcy's Law in ways they never imagined or have forgotten. They will learn about the most common difficulties encountered in evaluating the hydrogeology of local sites, and how to make do with what you get when data are of bad quality and scant. Most important, attendees will learn how groundwater hydraulics and geochemistry are linked and how to use one to confirm or deny conclusions based on the other. Case studies

and problems will center on contamination and wetland issues, two of the most topical areas with which hydrogeologic work is done today.

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

Limit: 50. Fee: \$170, students \$150; includes course manual and lunch. CEUs: 0.8.

OTHER COURSES AND WORKSHOPS

K–16 workshops appear on p. 17.

TECHNIQUES IN HYDROTHERMAL ORE DEPOSITS

Saturday, October 24 and Sunday, October 25, 8:00 a.m. to 5:00 p.m. Sponsored by *Society of Economic Geologists*.

Modern geochemistry has produced many techniques that are applicable to the study of hydrothermal ore deposits, and these have been used to determine everything from the date of mineralization to the sources of hydrothermal fluids. However, the results of such studies are too often overlooked as being of academic interest only. This course aims to show that many of the methods are in fact quite straightforward and to provide a basic understanding of data interpretation. The course is designed for anyone with a beginner's interest in modern techniques and how they can be applied to real systems. The short course volume is included in the registration fee.

Limit: 100. Cost: \$290 SEG members; \$390 nonmembers; \$200 certified students. Preregistration required. Send check, payable to Society of Economic Geologists, 5808 South Rapp St., Suite 209, Littleton, CO 80120; (303) 797-0332, fax 303-797-0417. Major credit cards also accepted.

CLASTIC FACIES AND SEQUENCE STRATIGRAPHY FOR GRADUATE STUDENTS ONLY

Saturday, October 24 and Sunday, October 25, 8:00 a.m. to 5:00 p.m. Sponsored by *Exxon Production Research Company*.

This course is designed to teach graduate students the principles, concepts, and methods of

sequence stratigraphic analysis in clastic strata. Sequence stratigraphy utilizes an integrated approach to studying depositional systems and is critical to developing a framework for analysis of reservoir-aquifer connectivity in both hydrocarbon and environmental applications. Focusing on the fundamentals of sequence stratigraphy, this course provides the participants with hands-on experience in depositional facies analysis using outcrop and core together with well-log and seismic data. These objectives will be accomplished through a combination of lectures and exercises, including many of the classic case studies from which the concepts of sequence stratigraphy were originally developed.

Limit: 30. No fee. Preregistration required. For information: Art Donovan, Exxon Production Research Company, (713) 431-7608, art.d.donovan@exxon.sprint.com; or Morgan Sullivan, Exxon Production Research Company, 3120 Buffalo Speedway, Houston, TX 77098, (713) 431-6396, fax 713-431-4114, morgan.d.sullivan@exxon.sprint.com.

ISOTOPE PALEOBIOLOGY AND PALEOECOLOGY

Sunday, October 25, 8:00 a.m. to 5:00 p.m. Sponsored by *Paleontological Society*.

Geochemistry is an increasingly important tool in paleontology. This course will describe the application of geochemical techniques to problems in evolution, the ecology and ontogeny of extinct organisms, and biosphere evolution. The focus is on current "hot" areas of research in which stable isotope methods are used to understand the biology and environmental context of ancient organisms. Topics include protistan and vertebrate ecology, approaches to measuring growth rates and life spans of mollusks, evolution of photosymbiosis and chemosymbiosis, as well as the linkage between ecology and morphology in planktic foraminifera, geochemical proxies for productivity, ecosystem evolution in the Phanerozoic and Precambrian, and ecosystem recovery following mass extinctions. The course is designed for a wide audience including students, biologists, geologists, and educators. Geochemistry is a "black box" for many people, so our aim is to discuss pitfalls and methods of geochemistry as well as their application to paleontological questions.

FACULTY: Richard D. Norris, Richard Corfield, H. Spero, D. Jones, R. Barrick, P. Pearson, M. Arthur, S. D'Hondt, A. Knoll, P. Allison, D. Briggs, R. Evershed, and E. Cobabe.

No fee or registration. Course notes will be available for purchase on-site. For information: Richard D. Norris, Dept. of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, MA 02543-1541, (508) 289-2839, fax 508-457-2187, RNorris@whoi.edu; or Richard M. Corfield, Dept. of Earth Sciences, University of Oxford, Parks Road, Oxford OX1 3PR, UK, richard.corfield@earth.ox.ac.uk.

RADIOGENIC AND STABLE ISOTOPES IN CHRONOSTRATIGRAPHIC, PALEO-ENVIRONMENTAL, AND BASIN ANALYSIS

Saturday, October 24, 8:00 a.m. to 5:00 p.m., and Sunday, October 25, 8:00 a.m. to 1:00 p.m. Sponsored by *SEPM (Society for Sedimentary Geology)*.

This course will give a historical account of isotope stratigraphy and an introduction to



the principles of isotope geochemistry. It will develop a template for integrating field and subsurface-based isotope stratigraphies with other traditional stratigraphic techniques coupled with radiometric dating through a series of interactive lectures and discussions. Topics include: (1) historical perspective of the role of isotope stratigraphy in stratigraphic studies; (2) review of stable isotope systematics including discussion of secular variation in seawater isotopic composition through Earth history, and of the utility of stable isotopes for paleoenvironmental reconstruction; (3) introduction to radiogenic isotope systems including a discussion of the Sr isotope evolution of Earth, the utility of radiogenic isotopes as tracers of the hydrological cycle, and an overview of the principles of geochronology; (4) concepts and methodology of isotope stratigraphy and application of high-resolution integrated stratigraphy to paleoenvironmental studies and basin analysis. Multiple case studies from a wide variety of depositional settings throughout Earth's sedimentary record will be presented. This

course should appeal to students and professionals who seek an introduction to the application of isotopes to sedimentary geology, as well as to those interested in new chronostratigraphic techniques and their utility for reservoir-scale basin analysis, global correlation, and studies of the biological and physical evolution of Earth.

FACULTY: Isabel P. Montañez, University of California, Davis; A. Jay Kaufman, University of Maryland; Jay L. Banner, University of Texas, Austin; Michael A. Arthur, Pennsylvania State University.

Limit: 50. Fee: \$190 SEPM members, \$220 non-members, \$120 students; includes short course notes and refreshment breaks. CEUs: 1.2. Preregistration required. For information and registration: Judy Tarpley, Continuing Education and Meetings Coordinator, SEPM, 1731 E. 71st St., Tulsa, OK 74136, 1-800-865-9765, or (918) 493-3361, ext. 22, fax 918-493-2093, jtarpley@sepm.org.

FORUM

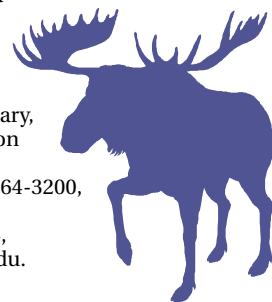
DIGITAL DATABASE FORUM

Sunday, October 25, 2:00 to 5:00 p.m.

Sponsored by *Geoscience Information Society*.

This forum offers participants an opportunity to learn about products and services in the area of digital data and information sources for the geosciences. This year's forum will feature the latest trends in electronic resources, from document-delivery vendors to electronic journals.

No fee or registration. For information: Adonna Fleming, Owen Science & Engineering Library, #3200, Washington State University, Pullman, WA 99164-3200, (509) 335-7601, fax 509-335-2534, afleming@wsu.edu.



K-16 Educational Programs

K-16 TEACHERS, GRADUATE STUDENTS, AND SCIENTISTS

GSA and its SAGE (Science Awareness through Geoscience Education) program invite you to join us in Toronto for an outstanding K-16 Education Program. Our program has something for everyone; geoscientists, students, and K-16 teachers. Plan to preregister and come early.

Fees are given in U.S. dollars.

PROJECTS FOR MULTICULTURAL AND INTERDISCIPLINARY STUDY AND EDUCATION (PROMISE)

Saturday, October 24, 8:00 a.m. to 12:00 noon, Delta Chelsea Inn. Sponsored by the *University of Nevada, Las Vegas*, the *National Science Foundation*, and *GSA's SAGE Program*.

PROMISE is a three-year, NSF-funded, Social Study of Geology project housed on the University of Nevada—Las Vegas campus. The PROMISE team develops thematic teaching modules and curricula content-analysis programs to reform earth science courses, pedagogy, and classroom environments to make science inviting for traditionally marginalized students, particularly women; place the study of earth systems in its social-historical context; examine the race, class, and gender dynamics that shape scientific knowledge. The target audience for this workshop is earth science teachers at the high school, community college, and university levels.

Limit: 40. No fee. Registration required. For information: Margaret Rees, Dept. of Geology, University of Nevada, Las Vegas, 4505 Maryland Parkway, Las Vegas, NV 89154, (702) 895-4064, rees@nevada.edu.

FIELD TRIP TO DUFFERIN AGGREGATES QUARRY

Saturday, October 24, 8:00 a.m. to 5:00 p.m., Sponsored by the *Local Education Committee*

of GSA, University of Toronto Department of Geology, and GSA's SAGE Program.

The cuesta of the Niagara escarpment results from the undermining of the dolomite caprock. The less resistant older beds are exposed by the dip of lower Paleozoic formations into the Michigan Basin. We will examine the formation of the Niagara escarpment, learn about its use as a source of aggregate, see rehabilitation of the quarry, and discuss environmental issues. There will be an opportunity to collect fossils and to enjoy the autumn colors. This trip is intended for teachers and high school to university students.

Limit: 85. Cost: \$8 (includes transportation and hand-outs). Registration required. For information: Kathleen Kemp, Dept. of Geology, University of Toronto, 22 Russell Street, Toronto, ON, M5S 3B1, Canada (416) 978-4381, kemp@quartz.geology.utoronto.ca.

EXPLORING THE SOLAR SYSTEM IN THE CLASSROOM: A HANDS-ON APPROACH

Saturday, October 24, 8:00 a.m. to 5:00 p.m., Delta Chelsea Inn. Sponsored by *GSA Planetary Geology Division, National Aeronautics and Space Administration (NASA), Space Grant*, and *GSA's SAGE Program*.

Have you ever wondered what another planet's surface looked like, or how it formed? Come explore our solar system in a fun-filled, action-packed, day-long workshop. We will use numerous hands-on activities to explore the many geologic processes that are active in our solar system. Workshop activities are targeted at teachers of grades 4-8, pre-service teachers, and others who work with upper elementary and secondary teachers and students. Registered participants will receive classroom materials including recent posters, maps, slide sets, activity workbooks, and much more.

Limit: 40. Cost: \$5. Registration required. For information: Cassandra Coombs, Dept. of Geology, College of Charleston, 66 George St., Charleston, SC 29424, (803) 953-8279, fax 803-953-5446, cass@loki.cofc.edu.

NATIONAL ASSOCIATION OF GEOSCIENCE TEACHERS WORKSHOP ON INNOVATIVE AND EFFECTIVE TECHNIQUES FOR TEACHING GEOSCIENCE

Saturday, October 24, 8:00 a.m. to 5:00 p.m., Delta Chelsea Inn. Sponsored by *National Association of Geoscience Teachers, National Science Foundation*, and *GSA's SAGE Program*.

This workshop will present innovative strategies for teaching geoscience at the undergraduate level, as well as specific examples of how to integrate such strategies into various types of courses.

Limit: 40. Cost: \$15. Registration required. For information: R. Heather Macdonald, Dept. of Geology, College of William and Mary, Williamsburg, VA 23187, (757) 221-2443, fax 757-221-2093, rhmacd@facstaff.wm.edu.

DEVELOPING UNDERGRADUATE RESEARCH PROGRAMS—STRATEGIES FOR SUCCESS

Sunday, October 25, 8:00 a.m. to 12:00 noon, University of Toronto. Sponsored by the *Council on Undergraduate Research (CUR)*.

Faculty, administrators, and representatives of funding agencies will share successful strategies and approaches related to implementing undergraduate research. The workshop will be organized around the different perspectives represented by different stakeholders. It is aimed at geoscience faculty inexperienced with undergraduate research, but committed to trying it, and faculty who are just beginning to explore the topic, including institutional support and external funding.

Limit: 30. Cost: \$35. Registration required. For information: John W. Creasy, Bates College, 44 Campus Ave., Lewiston, ME 04240, (207) 786-6153, fax 207-786-8834, jcreasy@bates.edu; Edward Hansen, Dept. of Geology, Hope College, 35 E. 12th St., Holland, MI 49422.

LEARNING FROM THE FOSSIL RECORD

Sunday, October 25, 8:00 a.m. to 5:00 p.m., University of Toronto. Sponsored by



Upper Middle Road. Stress release feature in Late Ordovician shales of the Queenston Fm.
—Photo by E. B. Freeman

Paleontological Society, Society of Vertebrate Paleontology, University of California Museum of Paleontology, Paleontological Research Institute, and GSA's SAGE Program.

Participants will learn about the effectiveness of using paleontology in the classroom to teach major concepts promoted by the National Standards. The study of the history of Earth and of ancient life is a very user-friendly way of teaching science and provides a natural integration of the multiple disciplines of science. This workshop will concentrate on what science is and is not, teaching the process of science, major concepts in paleontology and related sciences, and available resources for teachers and their students. The format will be a combination of informative sessions followed by hands-on activities presented by grade level. All participants will receive free materials for the classroom and a complimentary copy of a 300-page book full of information, activities, and resources.

Limit: 60. Cost: \$20. Registration required. For information: Judy Scotchmoor, University of California, Museum of Paleontology, Berkeley, CA 94720, (510) 642-4877, judys@ucmp1.berkeley.edu.

IDIG FORUM—SYSTEMIC IMPLEMENTATION OF GEOSCIENCE EDUCATION REFORM

Sunday, October 25, 8:00 a.m. to 5:00 p.m., University of Toronto. Sponsored by the *American Geological Institute (AGI)*, and *GSA's SAGE Program*.

The morning session will consist of informal presentations of team projects evolving from the 1998 Improving Delivery in the Geosciences (IDIG) conference. The afternoon will consist of participant project review.

Limit: 30. No fee. Registration required. For information: Marilyn Suiter, American Geological Institute, 4220 King St., Alexandria, VA 22302, (703) 379-2480, ms@agi.agiweb.org.

NATIONAL ASSOCIATION OF GEOSCIENCE TEACHERS: MORE ON INNOVATIVE TEACHING TECHNIQUES—SHARING WHAT YOU'RE DOING

Sunday, October 25, 8:30 a.m. to 12:00 noon, University of Toronto. Sponsored by the *National Association of Geoscience Teachers, National Science Foundation*, and *GSA's SAGE Program*.

Participants will share activities and assignments for undergraduate geoscience courses which promote active learning and will discuss the challenges of using innovative strategies. Leaders: R. Heather Macdonald and Barbara J. Tewksbury.

Limit: 30. Cost: \$5. Registration required. For information: Heather Macdonald, Dept. of Geology, College of William and Mary, Williamsburg, VA 23187, (757) 221-2443, fax 757-221-2093, rhmacd@facstaff.wm.edu; Barbara Tewksbury, Dept. of Geology, Hamilton College, Clinton, NY 13323, (315) 859-4713, fax 315-859-4807, btewksbu@hamilton.edu.

CANADIAN EDUCATION SYMPOSIUM: IN SEARCH OF LOST TIME

Sunday, October 25, 9:00 am to 12 noon, University of Toronto. Sponsored by the *Local Education Committee of GSA*, and the *University of Toronto Department of Geology*. Derek York, University of Toronto, and Robert C. Walter, Royal Ontario Museum.

"Time came into being with the heavens" (Plato, in *Timaeus*, ca. 388 B.C.). One of the great triumphs of 20th century science was the discovery by earth scientists that Earth is 4.5 billion years old. Equally profound philosophically has been the demonstration that humans are a remarkably recent product of natural selection. We will first describe the evolution of our understanding of the age of Earth during the past two millennia, what the author John McPhee calls "deep time," highlighting the contributions of Nier, Gerling, Holmes, and Houtermans, which culminated with Patterson's brilliant meteorite-based breakthrough. We will then examine the extraordinary progress made in the past three decades in establishing the time scale of human evolution over the past 4 million years. Such numerical calibrations are crucial to understanding rates and timing of evolutionary change. We will explain how this required the combination of patient field work, nuclear reactors, mass spectrometers, and lasers, a far cry from the reading of Genesis.

Limit: 400. Cost: \$8 (for lunch). Registration is required for those who wish lunch; otherwise, anyone who has registered for GSA may attend. For information: Kathleen Kemp, Dept. of Geology, University of Toronto, 22 Russell Street, Toronto, ON, M5S 3B1, Canada, (416) 978-4381, kemp@quartz.geology.utoronto.ca.

DIRECTING UNDERGRADUATE RESEARCH—STRATEGIES FOR SUCCESS

Sunday, October 25, 1:00 to 5:00 p.m., University of Toronto. Sponsored by the *Council on Undergraduate Research (CUR)*, *Keck Geology Consortium*, and *National Association of Geoscience Teachers (NAGT)*.

Faculty will share successful strategies and approaches related to undergraduate research. Topics will be: (1) developing research problems with undergraduates—examples from classroom research projects; (2) developing and maintaining a supportive research environment with diverse groups of undergraduate students—examples from group research projects; (3) bringing closure to an undergraduate research project—examples from independent student research. This workshop is aimed at geoscience faculty currently supervising undergraduate research both within the classroom setting and beyond, as well as faculty who are preparing to supervise undergraduate research in the future.

Limit: 30. Cost: \$35. For information: Cathryn A. Manduca, Dept. of Geology, Carleton College, Northfield, MN 55057, (507) 646-4425, fax 507-646-4400, manduca@carleton.edu; Jeffrey W. Niemitz, Dept. of Geology, Dickinson College, Carlisle, PA 17013, (717) 245-1285, fax 717-245-1971, niemitz@dickinson.edu; Ginny

Peterson, Dept. of Geosciences, Western Carolina University, Cullowhee, NC 28723, (704) 227-7367, fax 704-227-7647, peterson@wcu.edu.

CANADIAN EDUCATION WORKSHOPS SESSION I: MINERAL CRYSTAL CLUSTERS

Sunday, October 25, 1:00 to 2:30 p.m., University of Toronto. Sponsored by *Mining Matters*, the *Local Education Committee of GSA*, and the *University of Toronto Department of Geology*.

Participants in this workshop will construct 3-D models of crystals and will learn about minerals and their corresponding crystals. They will come away with the necessary materials to implement this half-day visual art activity with their students. This is an intermediate-level (grades 6 and 7) activity taken from the *Mining Matters—Une Mine de Renseignements* unit. It respects Learning Outcomes and Expectations from the Ontario Ministry of Education and Training.

Limit: 35. Cost: \$5. Registration required.

SESSION II: GOLD DIGGERS' DAYS

Sunday, October 25, 2:30 to 4:00 p.m., University of Toronto. Sponsored by *Mining Matters*, the *Local Education Committee of GSA*, and the *University of Toronto Department of Geology*.

By participating in this workshop you will learn about gold the mineral and gold the mystical metal. You will also learn how to best implement a grades 6 and 7 two-day unit on gold, integrating science, language, geography, mathematics, and history. You will come away with a mini-unit plus some of the materials necessary to implement it. This is a complementary topic to the *Mining Matters—Une Mine de Renseignements* unit. It respects Learning Outcomes and Expectations from the Ontario Ministry of Education and Training.

Limit: 35. Cost: \$5. Registration required. For information: Kathleen Kemp, Dept. of Geology, University of Toronto, Toronto, ON M5S 3B1, Canada, (416) 978-4381, kemp@quartz.geology.utoronto.ca.

ROYAL ONTARIO MUSEUM SCHOOL PROGRAMMING

Sunday, October 25, 2:30 to 4:00 p.m., Royal Ontario Museum. Sponsored by the *Royal Ontario Museum*, and the *Local Education Committee of GSA*.

Visit the Royal Ontario Museum for an introduction to the Discovery Gallery, outreach displays, studio programming, mini-planetarium, and Science and Technology Week events. The museum has something for all levels of education. This session will appeal to teachers, museum educators, and students.

Limit: 100. No fee. Registration required. For information: Ron Miles (416) 586-5805, or ronm@rom.on.ca

GEOSCIENCE EDUCATION DIVISION BREAKFAST

Monday, October 26, 7:00 to 8:30 a.m.

OCEANOGRAPHY WORKSHOP

Monday, October 26, 9:00 a.m. to 12:00 noon, Delta Chelsea Inn. Sponsored by *GSA's SAGE Program*.

This workshop will present four physical oceanography modules developed by the American Meteorological Society and the U.S. Naval Academy. The topics are Ocean Tides,

Tides on the Internet, Measuring Sea Level From Space, and Coastal Upwelling. Each module is accompanied by a hands-on activity and written material. It is designed for pre-college educators, although it would be useful for introductory earth science, geology, and oceanography courses for nonmajors at the college level.

Limit: 30. No fee. Registration required. For information: Mary Alice Fryar, 5915 Saxony Woods Lane, Jacksonville, FL 32211, (904) 727-0987.

NAGT LUNCHEON

Monday, October 26, 11:30 a.m. to 2:00 p.m.

EARTHCOMM WORKSHOP

Monday, October 26, 1:00 to 4:00 p.m., Delta Chelsea Inn. Sponsored by the *American Geological Institute (AGI)*, and GSA's *SAGE Program*.

This workshop is designed for high school teachers and pre-service teacher education faculty. In this workshop we will introduce the philosophy as well as the educational goals of EarthComm. Participants will also actively explore EarthComm materials.

Limit: 30. No fee. Registration required. For information: Marilyn Suiter, American Geological Institute, 4220 King St., Alexandria, VA 22302, (703) 379-2480, ms@agi.agiweb.org.

EARTH SCIENCE EDUCATORS AND PEP MEMBERS SOCIAL HOUR

Monday, October 26, 4:00 to 5:30 p.m., Metro Toronto Convention Centre.

EARTH SCIENCE INFORMATION "SHARE-A-THON" FOR K-16 EDUCATORS

Monday, October 26, 4:00 to 5:30 p.m., Metro Toronto Convention Centre.

The Share-a-thon is designed to promote the sharing of teacher-developed earth science materials and ideas. Teachers are invited to present earth science activities 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. Registration required only for presenters. To be a presenter, check the appropriate box on the GSA Annual Meeting registration form in this issue.

ROCK RAFFLE

Monday, October 26, 4:00 to 5:30 p.m., Metro Toronto Convention Centre.

Outstanding specimens of rocks, minerals, and fossils could be yours! Come to the Rock Raffle and bid on your favorite sample. All proceeds go to the National Earth Science Teachers Association (NESTA).

Special Programs

EMPLOYMENT SERVICE

Sunday, October 25, 12:00 noon to 5:00 p.m.; Monday, October 26 through Wednesday, October 28, 8:00 a.m. to 5:00 p.m. Metro Toronto Convention Centre, Room 808.

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. Interview booths may be reserved at the meeting in half-day increments for a nominal fee. GSA staff will handle all interview scheduling with Employment Service applicants.

Many job seekers have found the Employment Interview Service critical to their successful search for positions. The annual registration fee is \$30 for GSA members and associates, and \$60 for nonmembers. This fee provides year-round service, but also includes interviewing at the annual meeting. Students completing doctoral and master's theses during 1998 are particularly encouraged to join the Employment Service and to check the job offerings at the meeting.

Applicants who sign up with the Employment Service by August 30, 1998, will have their information included in the materials that employers receive prior to the meeting, so submit your application form and résumé early to receive maximum exposure—and be sure to indicate on the form that you will be attending the meeting.

For additional information or forms, contact T. Michael Moreland, Membership Services

Manager, GSA headquarters, (303) 447-2020; member@geosociety.org or see GSA's World Wide Web site at <http://www.geosociety.org>, and check under the Membership section.

EMPLOYMENT OPPORTUNITIES IN THE GEOLOGICAL SCIENCES ROUNDTABLE DISCUSSIONS

Sunday, October 25, 1:00 to 3:00 p.m. Metro Toronto Convention Centre, Room 808.

This annual forum on employment opportunities in the geosciences allows valuable one-on-one interaction between panel members and individuals or small groups. Experts in each of the areas listed below will conduct his or her own "mini-roundtable" discussion designed to provide a better opportunity to field both gen-

eral and specific questions on a more personal, individualized basis.

These roundtable discussions will be in the Employment Service area during the interview registration time; however, *you do not have to be signed up for either the annual meeting or the Employment Service to participate in these discussions.*

Everyone—professionals and students—is encouraged to attend, to talk with as many of the experts as you like, and to pick up a free copy of the informational booklet "Future Employment Opportunities in the Geological Sciences."

Roundtable discussion leaders from the following areas will be featured this year: Academic and Educational; Mining; Federal Government; State and Local Government;

ATTENTION, STUDENTS!

PRESIDENT'S STUDENT BREAKFAST RECEPTION

MONDAY, OCTOBER 26, 7:30 TO 8:30 A.M., METRO TORONTO CONVENTION CENTRE, HALL D

GSA President Vic Baker invites all the students registered for the meeting to attend a free breakfast buffet sponsored by Exxon. Vic and members of the GSA Executive Committee will be on hand to answer questions and address student issues. Registered students will receive complimentary coupons redeemable toward breakfast during this reception. Take this opportunity to network with fellow students and meet the officers of GSA.

GRADUATE SCHOOL INFORMATION FORUM

MONDAY, OCTOBER 26 THROUGH WEDNESDAY, OCTOBER 28, 9:00 A.M. TO 5:30 P.M., METRO TORONTO CONVENTION CENTRE, HALL D

STUDENTS: This is a great opportunity for you to search for the right graduate school. Come to Toronto and meet with representatives of top graduate schools without spending the travel time and money to go to each school for information and interviews.

UNIVERSITIES: For your name to appear in the September issue of *GSA Today* and the on-site *Program*, the deadline for reservations is *July 15, 1998*.

A complete list of participating schools, with contact names and telephone numbers, is available. A schedule of participating schools will be published in the September issue of *GSA Today*. If you would like to reserve a space for your school or receive the list of participants, please contact Tammy White at twhite@geosociety.org or (303) 447-2020, ext. 141.

Toronto skyline
— Photo by Peter Mintz



Petroleum; Consulting; and Federal Legislation and Environmental Restoration.

For further information, contact T. Michael Moreland, Membership Services Manager, GSA headquarters, member@geosociety.org.

IEE ANNUAL ENVIRONMENTAL FORUM: THE SUSTAINABILITY CHALLENGE I: ENERGY FOR THE 21ST CENTURY

Sunday, October 25, afternoon. Cosponsored by the *Institute for Environmental Education* and *Critical Issues Committee*. A. R. Palmer, Institute for Cambrian Studies; E-an Zen, University of Maryland.

One of the most controversial and pressing environmental concerns of our time is our dependence on nonrenewable fossil fuel resources. This session explores the economic realities and environmental consequences of this dependence and how geoscientists can contribute to public understanding and resolution of this problem. Issues to be discussed include: How good are the estimates of petroleum resources?; mathematically robust calculations for the timing of the decline of global oil production; the growing importance of renewable energy; petroleum industry initiatives in renewable energy resources; myths and realities of alternative energy sources; what our priorities should be regarding use of the declining oil supply; the political reality of shrinking oil supplies; will the transition be peaceful?

FROM THE OUTCROP TO THE HILL: A YEAR OF CORRELATING SCIENCE AND PUBLIC POLICY

Wednesday, October 28,
12:00 to 1:00 p.m.,
Sponsored by *Geology and Public Policy Committee*.



The GSA Congressional Science Fellow Program provides an unparalleled opportunity for an earth scientist to apply scientific and technical expertise to a wide range of policy issues as a staff member in a Congressional or committee office. GSA's twelfth Congressional Science Fellow, David Verardo, serves on the legislative staff of U.S. Senator Ron Wyden (D—OR). At this session, Dave will address the GSA community on geoscience issues facing the

U.S. Congress and discuss the positive roles available for all earth scientists in policy formulation.

Funded by GSA and by a grant from the U.S. Geological Survey, the Congressional Science Fellowship Program is an integral element of GSA strategies to increase involvement by the earth science community in public policy.

GEOLOGY AND PUBLIC POLICY FORUM: GEOSCIENCE ETHICS IN ENVIRONMENTAL AND NATURAL RESOURCE ISSUES

Wednesday, October 28, 1:30 to 3:30 p.m.,
Sponsored by the *GSA Geology and Public Policy Committee*.

What is the appropriate role for the geosciences in a democratic society struggling with the ever-changing, symbiotic relationship between humans and Earth? How do the goals of democracy, science, and sustainability shape our personal and professional ethics? How can geoscientists be effective researchers and problem-solvers in conflicts that are often enmeshed with politics and power? How do the geosciences respond when the issues transcend political boundaries and governing systems? Special guest panelists will offer perspectives from both within and outside the geosciences, setting the stage for open discussion among the forum attendees and beyond.

Special Occasions

150th Anniversary of Geology at the University of Toronto

Do the names E. J. Chapman, J. Burr Tyrrell, Duncan R. Derry, J. Tuzo Wilson, M. A. Peacock, and W. A. Parks ring a bell? The traditions established by these geological leaders have become well known to scientists and to the public who have benefited from their academic excellence and commitment to geology. All served as faculty of the University of Toronto's Department of Geology. Congratulations to the present faculty and students of this cornerstone of the science.

50th Anniversary of the American Geological Institute

AGI is only one-third as old as the University of Toronto Department of Geology, but likewise serves the purposes of the geosciences. We congratulate AGI for its leadership and support of its member organizations for 50 years.

Dedication of the Geological Interpretation Program

The public dedication of the Don Valley Brick Works Geological Interpretation Program will be held in conjunction with GSA's presence in Toronto. Excavations at the site of the former brick works have revealed the most complete record of climate change during the last interglacial period. Once threatened by housing development, the site has now been acquired for public use and geologic displays and education, thanks to the efforts of Toronto's geological community.

PDAC Mining Matters

Congratulations to the Prospectors and Developers Conference ongoing secondary school educational program, funded by more than 50 Canadian mining corporations. In 1997, Mining Matters won the Partnership Focus Award for promoting science literacy for the world of work for the elementary level. You'll be able to see Mining Matters teaching materials in the University of Toronto's exhibit booth.

TORONTO SYMPHONY ORCHESTRA AND DINNER

**FEES ARE GIVEN
IN U.S. DOLLARS**

Saturday, October 24, 6:00 to 10:00 p.m.

This special evening will include a pre-concert dinner and the Toronto Symphony Orchestra, conducted by Peter Oundjian, playing light classics, including music by Rossini, Vaughan Williams, Bizet, and others. Nancy Morris Adams of Travel to Music will host this event. In September, Nancy will send you the name and location of the restaurant and other timely information. Preregistration only.

Limit: 50. Cost: \$65

DINNER AND THE TORONTO PATH

Saturday, October 24,
6:00 to 10:00 p.m.



The PATH is Toronto's downtown walkway, linking 10 kilometers of underground services, restaurants, shopping, and entertainment. Join us for a geological, architectural, and historical tour through part of Toronto's underground, led by local geologist Ed Freeman. The 60-minute tour culminates with a delicious dinner and drinks at Old Ed's, a Toronto landmark restaurant with an intriguing museum of antiques, art objects, and theatrical memorabilia. The tour begins at the Sheraton Centre Toronto Hotel Lobby at 6:00 p.m. Return to your hotels will be by a leisurely 15-minute walk.

Limit: 40. Cost inclusive (except alcoholic beverages): \$30

PATH WALKING TOUR (TORONTO TREKKIES!)

Sunday, October 25,



at 3:00 p.m., 3:15 p.m., and 3:30 p.m.

On this complimentary tour, we walk the PATH to the GSA Welcoming Party. This guided tour will help you get acquainted with Toronto's amazing underground and connection to the Metro Toronto Convention Centre. The PATH offers extraordinary geologic features, public art, plus hundreds of restaurants, and shops. The walk will take about an hour and leaves at intervals from the Sheraton Centre Toronto Hotel Lobby. The GSA shuttle will bring you back to your hotel after the Welcoming Party. Registration for the tour is not necessary, and there is no fee. Everyone is welcome!

EXHIBITS OPENING AND WELCOMING PARTY

Sunday, October 25, 5:00 to 7:30 p.m., Metro Toronto Convention Centre, Halls D and E

Register, then join your colleagues and exhibitors during this event and celebrate the grand opening of the 1998 GSA Annual Meeting and Exposition! This is the time to meet with friends and plan the next four days of networking and meeting activities. Relax and take this uninterrupted opportunity to view the exhibits, eat, and enjoy your favorite beverage. A complimentary drink ticket will be provided with all paid meeting registrations. Meeting registration is required. A pass for the Exhibit Hall only is available for \$20 and is good for admission to the exhibits

throughout the meeting. Registration will remain open until 7:30 p.m. for your convenience.

AWARDS LUNCHEONS AND OTHER TICKETED GROUP FUNCTIONS

Associated Societies and GSA Divisions invite their members and other interested guests to join them for their annual meal functions, special addresses, and awards ceremonies. Because of catering guarantee deadlines, only a few tickets will be available on-site. Therefore, we recommend purchasing your tickets in advance, using the preregistration form. Check the preregistration form on p. 30 for dates. Location and time of events will appear on your ticket and in the 1998 Annual Meeting Program.

GSA PRESIDENTIAL ADDRESS AND AWARDS CEREMONY

Monday, October 26, 5:45 to 7:45 p.m.,
Metro Toronto Convention Centre

The GSA Presidential Address and Awards Ceremonies will begin with President Victor Baker's address, *Geosemiosis*. A reception honoring the awardees will follow immediately.

■ PENROSE MEDAL

Jack E. Oliver

■ DAY MEDAL

Edward Bruce Watson

■ YOUNG SCIENTIST AWARD (Donath Medal)

Terry Plank

■ GSA DISTINGUISHED SERVICE AWARD

James R. Clark
June R. Forstrom
Charles J. Mankin

■ RECOGNITION WILL ALSO BE GIVEN TO NEWLY ELECTED HONORARY FELLOWS

Shigeo Aramaki
Victor E. Khain
Werner-Friedrich Schreyer

ALUMNI RECEPTIONS

Monday, October 26, 7:00 to 9:30 p.m.,
Sheraton Centre Toronto Hotel

Plan to join your former classmates for an evening of memories and renewed connections. Cash bars and hosted alumni parties are planned for about 60 colleges and universities. If you would like to hold an alumni party, check with your department head, who may have already requested this from GSA, or send e-mail to cgriswol@geosociety.org.

ROYAL ONTARIO MUSEUM WINE AND CHEESE RECEPTION

Tuesday, October 27, 5:30 to 8:00 p.m.

The GSA Shuttle will extend its regular route from all GSA hotels to and from the ROM between 5:00 and 8:00 p.m.

The ROM, as it's affectionately called, is Canada's largest museum, with more than six million objects in its collection. Explore the treasures during this evening that begins with a wine and cheese reception in Eaton Court, where you'll have a unique opportunity to meet the curators of the various exhibits and get an inside look at this world-renowned facility. Perhaps best (due to rush hour traffic) is to

take the subway for the 10-minute ride from Union Station, near the Convention Centre, direct to the Museum Stop on the University Line (Can\$2). After the reception and ROM visit, consider dining at one of the Bloor-Yorkville area restaurants. Restaurant information will be available at the Convention Centre's Toronto Restaurant Desk.

Limit: 300. Cost: \$20

TORONTO NIGHTLIFE PUB CRAWL

Wednesday, October 28, 7:00 to 11:00 p.m.

Visit four of Toronto's finest pubs. On this fun-filled evening, you'll be able to sample beers from a wide selection of Canadian and local microbreweries, as well as learn about the fascinating history of the area. The pub crawl begins from the Sheraton Centre Toronto Hotel Lobby. A shuttle bus will provide service between the convention hotels prior to the start time. Your ticket will include transportation, an opportunity to join in the evening's games, and a chance to win some great prizes. Participants are responsible for purchasing their own food and beverages. With space for only 200, we encourage you to register early!

Limit: 200. Cost: \$10

T.A.C. (Thursday Afternoon Club)

Thursday, October 29, 3:30 to 5:00 p.m.,
Metro Toronto Convention Centre

T.A.C. is for the meeting survivors, those who last until the end—or who have a paper on Thursday afternoon. Come to Hall E and help us say thank you to our Toronto committee. Beer and soft drinks are available, one free to each person who turns in a badge, plus there will be a cash bar.



Skeleton of Allosaurus, a large meat-eating dinosaur from the late Jurassic of western North America —Courtesy of the Royal Ontario Museum

The Women's Association of the Mining Industry of Canada extend a warm welcome to all the guests. We hope you enjoy your stay in our city and we look forward to helping you see and do the things you wish to while you are in Toronto.

FORMAL TOURS

All GSA meeting registrants are welcome to sign up for the formal tours offered as part of the Guest Program. Reservations for all tours will be accepted on a first-come, first-served basis. Space is limited and these trips will be popular, so register early. The tour operator requires a final guarantee several days in advance for most tours. Therefore, we recommend that you don't wait until you arrive in Toronto to sign up. All tours will leave from the Sheraton Centre Hotel, Richmond Street entrance. There will be *no* pick-ups from the other hotels or the Metro Toronto Convention Centre. Plan to arrive in the hospitality room about 15–20 minutes before scheduled departure, for check-in.

BIRD WATCHING IN SOUTHERN ONTARIO

Sunday, October 25, 7:00 a.m. to 3:00 p.m.

Join Ron Scovell, well-known Ontario field ornithologist, naturalist, and educator as he leads this very interesting trip. Scovell will be assisted by experienced ornithologists providing one guide for every 12 birders. To ensure the best experience, viewing sights will be selected immediately before your visit. Potential and probable sights will be in the Burlington-Hamilton area. A wonderful site may be Cootes Paradise—a huge marsh with numerous ducks, shore birds, and passerines. This is a beautiful area any time of year, so this is a trip not to be missed. Maximum: 36, minimum: 20. Cost: \$47 (includes transportation, guide, continental breakfast in the Hospitality Room beginning at 6:00 a.m., and boxed lunch).

LET THE CHARM OF THE NIAGARA REGION MESMERIZE YOU

Sunday, October 25, 8:30 a.m. to 4:30 p.m.

No trip to Ontario would be complete without a visit to Niagara Falls and the surrounding region. The Falls are awe-inspiring and you will not be disappointed as you are led to a vantage point just steps away from the brink of the Canadian "Horseshoe Falls." You will take a ride aboard the world-famous *Maid of the Mist*. The tour will cruise to the base of the American Falls. The historic village of Queenston is your next stop. You will have lunch at the Queenston Heights Restaurant with a view overlooking the Niagara River. Your final stop will be a highlight—the charming town of Niagara-on-the-Lake. Here you'll have time to stroll around, see the carefully preserved colonial homes, and enjoy shopping in the quaint craft and specialty shops. Note: It could be cool on the lake; please

dress accordingly. Maximum: 42, minimum: 30. Cost: \$68 (includes transportation, guide, *Maid of the Mist* cruise, and lunch).

FEAST ON FOOD, FACTS, AND SIGHTS OF THE NEWER QUARTER OF CHINATOWN

Sunday, October 25, 9:45 a.m. to 1:00 p.m.

This two-hour walking tour will start where the seeds of the Chinese community were planted 119 years ago and then transplanted to the present site. Escape the frenzy of life with a visit

to a tranquil Taoist temple to witness food offerings. Then you will visit the commercial strip to enjoy offerings from a tofu factory, a bakery, an herbalist, and a tea shop. At the dim sum meal that ends the tour, Shirly Lum of "A Taste of the World" will lead you through the pouring and sampling of tea, chopsticks etiquette, and Chinese horoscope reading. Maximum: 24, minimum: 12. Cost: \$58 (includes guide and lunch).

ACQUAINT YOURSELF WITH TORONTO

Sunday, October 25, 10:00 a.m. to 1:00 p.m.

Sit back and enjoy the sights as Toronto's fascinating past and vibrant present unfold. View the city's powerful skyline complete with skyscrapers and the magnificent CN Tower. After touring the financial and downtown area, you will see Toronto's shopping districts, art galleries, museums, and political and educational buildings. For a taste of Toronto's history, you'll see century-old churches, ethnic neighborhoods, the dynamic theater district, and the fairytale castle, Casa Loma. Maximum: 46, minimum: 30. Cost: \$20 (includes transportation and guide).

**FEES ARE GIVEN
IN U.S. DOLLARS**



TEASE YOUR SENSES—NIAGARA FALLS, THE BUTTERFLY CONSERVATORY, AND WINERY AND DISTILLERY TOUR

Monday, October 26, 8:30 a.m. to 6:00 p.m.

This guided tour starts as you travel through the industrial heartland southwest of Toronto en route to Niagara Falls. One small city after another come into view as well as the beautiful Niagara escarpment. Your first stop is the new Niagara Parks Butterfly Conservatory. After a five-minute video presentation you will have a guided tour. Traveling along the Niagara Parkway, you will next visit Ontario's number one tourist attraction—Niagara Falls, where there will be time to take photos. Next you'll travel west to the town of Jordan and have lunch at the renowned On the Twenty Restaurant at Cave Spring Cellars Winery. At the last stop, Grimsby and Kittling Ridge Winery, you will have a winery and distillery tour followed by wine tastings in the hospitality bar. Maximum: 42, minimum: 30. Cost: \$57 (includes transportation, guide, Butterfly Conservatory tour, lunch, and winery tour).

VISIT THE SKY

Monday, October 26, 9:00 a.m. to 1:00 p.m.

This tour is essentially the same as the Sunday "Acquaint Yourself With Toronto" tour, but enhanced by a visit to the CN Tower. This visit takes you up to the clouds to explore the world's tallest free-standing structure—the 550 meter CN Tower. The potential 120 km view offers sights of the city as well as a spectacular view across the lake and beyond Niagara Falls. Maximum: 42, minimum: 30. Cost: \$30 (includes transportation, guide, and admission to CN Tower).

DON VALLEY BRICK WORKS PARK

Monday, October 26, 1:00 to 4:00 p.m.

Don your walking shoes and join Toronto geologist Ed Freeman for a walk to view the autumnal colors. You will be introduced to Toronto's newest urban park by a guided tour of the wetland garden and wildflower meadow, and viewing the museum display at the Don Valley Brick Works Park. This world-famous site records the climate of the past 130,000 years. A leisurely walk along an old railway line to Toronto's best-known cemetery follows this tour. Note: This is not a strenuous walk, but dress appropriately. Maximum: 42, minimum: 20. Cost: \$20 (includes transportation and guide).

THE McMICHAEL CANADIAN ART COLLECTION AND SCENIC KLEINBURG

Tuesday, October 27, 9:00 a.m. to 3:00 p.m.

The McMichael Gallery is built of fieldstone and hand-hewn logs nestled in a woodland setting with stunning views of the surrounding Humber River Valley. The permanent collection comprises almost 6000 distinctively Canadian works of art. Your guided tour will cover the renowned Group of Seven and their contemporaries, spectacular Inuit sculpture, and prints and drawings from Canada's finest contemporary First Nations artists. The Gallery Shop features an extensive collection of books and gifts. A short distance from the McMichael's serene conservation ground lies the historic village of Kleinburg, where an



Don Valley Brick Works Park and Toronto
— Photo by E. B. Freeman

atmosphere of early Canadian traditions and architecture still prevails. There are quaint tea houses and the well-known Doctor's House Restaurant, which offers superb cuisine. This country village also has beautiful shops filled with Canadiana and intriguing gift ideas. Maximum: 42, minimum: 30. Cost: \$25 (includes transportation and guided tour of the McMichael Gallery).

A DAY IN THE COUNTRY

Tuesday, October 27, 9:30 a.m. to 4:30 p.m.

Your day in the country will be at the beautiful Millcroft Inn in Alton, a short trip north of Toronto. Take in the whispering pines, autumn colors, and cascading waterfalls as you meander or bicycle along the many wooded trails. Then come in and relax by the fire in a private dining room overlooking the river. An elegant and delicious luncheon will be served. After lunch, participate in a stress-management program conducted by Ginny Edwards. You will be taught new skills to assist you in coping with today's hectic and demanding world. You will learn through relaxation techniques to reflect and then refocus your energies in a positive way. Then, back to the city, newly invigorated! Dress should be casual and relaxed for the country. Maximum: 42, minimum: 30. Cost: \$45 (includes transportation, bicycle rental, lunch, and seminar).

A LUNCHEON-COOKING FORUM

Tuesday, October 27, 10:30 a.m. to 2:00 p.m.

Be inspired and entertained by one of Toronto's top chefs as you view close up the creation of an intriguing global menu featuring food full of passionate flavors and robust tastes from Southeast Asia and the Mediterranean. Appropriate fine wines will accompany the menu. This demonstration cooking class is held in a relaxed informal kitchen in one of Toronto's interesting developing neighborhoods. Maximum: 24, minimum: 12. Cost: \$55 (includes a short street car ride and lunch).

SIX HOUR SHOPPERS SHUTTLE

Wednesday, October 28, 9:30 a.m. to 3:30 p.m.

Toronto is a shoppers' paradise; this shuttle bus will make it possible to visit the city's best shopping areas and museums. Yorkville consists of four major streets with interesting boutiques, antique stores, and some of the city's best art galleries. The Royal Ontario Museum and the Gardiner Museum of Ceramic Art are within walking distance of this area and worth a visit.

At Harbourfront, visit Queen's Quay Terminal, with its wonderful mixture of specialty shops. Canada's largest antique market is also located in this area. Maximum: 42, minimum: 30. Cost: \$19 (includes transportation and guides).

ART GALLERY OF ONTARIO

Wednesday, October 28, 12:00 noon to 2:45 p.m.

The Art Gallery of Ontario is located in the middle of Chinatown, in the heart of downtown Toronto. The gallery is one of Canada's finest art museums, housing a collection ranging from the Old Masters to contemporary Canadian. The Henry Moore collection is possibly the finest in the world. Maximum: 45, minimum: 30. Cost: \$17 (includes transportation, admission, and guided tour).

HIGH TEA AT THE KING EDWARD HOTEL

Wednesday, October 28, 3:00 to 5:00 p.m.

As a finale to your stay in Toronto, enjoy high tea at the elegant, historic King Edward Hotel, long a favorite with Torontonians. Martha McKee from Waterford Wedgwood Canada, Inc., will entertain with a talk entitled "Teapots and Josiah Wedgwood." A piece of Wedgwood china will be given as a door prize at this event. Maximum: 45, minimum: 30. Cost: \$25 (includes transportation, and tea service). Note: The tour to the Art Gallery of Ontario and the high tea at the King Edward Hotel can be done as one tour, because they will be using the same bus. If you plan to do both, please purchase a ticket for each tour. We will return briefly to the Sheraton Centre Hotel between the two tours.

INFORMAL TOURS

Toronto has a great deal to offer, and the formal tours can cover only a small part of what is available to see. Your Hospitality Room hostesses have many suggestions—e.g., Bata Shoe Museum, Royal Ontario Museum, the Gardiner Museum of Ceramic Art, the Textile Museum, and the Ontario Science Centre. You might enjoy visiting one of the above or other area attractions with fellow guest attendees. Plan to sign up in the Guest Hospitality Room for these informal, self-guided tours.

GUEST HOSPITALITY ROOM

Beginning on Sunday, October 25, guests are invited to visit the Hospitality Room, located in the Simcoe and Dufferin Rooms on the second floor of the Sheraton Centre Hotel. Your local hosts will provide a resource center with abundant information on Toronto and the surrounding areas. Formal and informal tour information will be available. Light refreshments will be served throughout the day. Remember to wear your GSA badge; it will be required for admission to the Hospitality Room and the exhibit hall. Guest registration includes an exhibit hall pass but does not give access to the technical sessions. However, a guest can obtain a temporary pass to see a spouse or friend present a paper.

GUEST HOSPITALITY ROOM HOURS

Sunday	6:00 a.m. to 4:00 p.m.
Monday	7:00 a.m. to 4:00 p.m.
Tuesday	7:00 a.m. to 4:00 p.m.
Wednesday	7:00 a.m. to 4:00 p.m.
Thursday	7:00 a.m. to 12:00 noon

SEMINARS

Payment of the guest registration fee entitles you to attend the following presentations. Both will take place in the Guest Hospitality Room.

HARRIET TUBMAN AND THE UNDERGROUND RAILROAD—HER LIFE IN THE UNITED STATES AND CANADA

Monday, October 26, 10:00 a.m.

Join author Rosemary Sadlier as she recounts this fascinating story. Sadlier, as well as being the author of a number of books, is president of the Ontario Black History Society.

WHAT'S UP WITH THE WEATHER??? IS EL NIÑO TO BE BLAMED FOR EVERYTHING?

Tuesday, October 27, 10:00 a.m.

Ice storms in the east. Warm, mild winters in the midwest. Record rains on the west coast. Vic Tyrer, geographer at the Ontario Science Centre, will help us understand what is really happening and why.

Travel

Crossing the border is *easy*—thousands of people do it every day. Visit the GSA Toronto Web site for links to travel information: www.geosociety.org/meetings/98, then e-mail us if you have questions: meetings@geosociety.org. Call Tourism Toronto Visitor Information at 1-800-363-1990 for information on the city.

U.S. FEDERAL AND STATE EMPLOYEES

For the purposes of the GSA meeting, the Toronto destination will be considered non-foreign travel by the U.S. Geological Survey. Just be sure that your name is on the list to go

to Toronto. Other federal agencies may also have the same policy. State governments, however, may consider Canada as foreign travel, so please be sure that the GSA Annual Meeting is on the list for "approved" travel.

U.S. VISA HOLDERS

Please get in touch with your consulate *now*. You may travel easily into Canada, but you may encounter some questions when returning into the United States. Citizens or permanent residents of other countries must have a valid passport and/or a valid visitors visa and should contact their local Canadian Embassy/Consulate, or High Commission Office for further qualification.

TRAVEL AND IMMIGRATION INFORMATION FOR CONVENTION DELEGATES

Citizens or permanent residents of the United States can usually cross the border without difficulty or delay. However, certain types of identification are required by both Canada and U.S. Immigration. For native-born Americans and/or U.S. citizens, Canadian Immigration requires either a passport *or* a birth certificate, supported by photo ID. For return entry, U.S. Immigration officials also suggest that you have one of these items with you, in addition to your normal identification. A permanent resident who is not a citizen is required to possess an

alien-registration card (1551 or 1151 form) or Green Card by both U.S. and Canadian Immigration. Naturalized citizens need naturalization certificates with picture ID.

Direct questions about entry into Canada to: Canadian Immigration Division, Citizenship and Immigration, Place du Portage, 140 Promenade du Portage, Phase 4, Hull, Quebec K1A 1L1, Canada, or call (819) 994-2424. For further information on U.S. Customs, please call (905) 676-2606.

GSA'S OFFICIAL CUSTOMS BROKER

Mendelsson-Commercial Customs Brokers have been contracted as GSA's official Customs Broker. Mendelsson-Commercial provides specialized customs brokerage and transportation services for attendees and exhibitors importing goods for use at the meeting. Contact them at (416) 863-9339 or fax 416-863-5149. Visit their home page at www.mend.com, or e-mail brokers@mend.com.

TRAVEL GRANTS FOR STUDENT MEMBERS OF GSA

The GSA Foundation has awarded matching grants to the six GSA sections. The money,

when combined with equal funds from the sections, is used to assist student members of GSA traveling to GSA meetings. The following sections offer assistance to the Annual Meeting in Toronto. The remaining two sections, Cordilleran and Rocky Mountain, offer assistance to their section meetings. For information and deadlines, contact your Section Secretary.

- **North-Central:** Robert F. Diffendal, Jr. (402) 472-7546, rfd@unlinfo.unl.edu
- **Northeastern:** Kenneth N. Weaver (410) 554-5532, kweaver438@aol.com
- **South-Central:** Rena M. Bonem (254) 710-2361, Rena_Bonem@baylor.edu
- **Southeastern:** Harold H. Stowell (205) 348-5098, hstowell@wgs.geo.ua.edu

GETTING TO YOUR HOTEL

The Lester B. Pearson International Airport is located in the northwestern corner of Toronto and is about 30 to 40 minutes from downtown. None of the downtown hotels offer free transportation to and from the airport. The Airport Express Pacific Western Shuttle provides service from the airport to the major downtown hotels. Cost is approximately Can\$12.50 one way. Taxi service to and from the airport is approximately Can\$35 one way.

GETTING AROUND IN TORONTO

GSA SHUTTLE. Only two of the GSA Toronto hotels are within easy walking distance from the Convention Centre; however, GSA will provide shuttle service between the other GSA-selected hotels and the Convention Centre throughout the week beginning on Sunday, October 25. *Note: Traffic in downtown Toronto is heavy, especially during rush hour, so allow yourself plenty of time to get between the Convention Centre and the GSA hotels to meetings and events.*

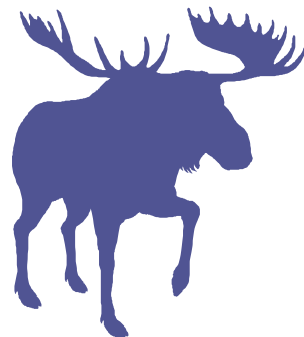
TAXICABS. Taxi service (24 hour) costs approximately Can\$2.50 plus Can\$2 per kilometer. For longer trips, like rides to the airport, you can usually work out a flat rate with the driver in advance. The bellman at most hotels can call for a taxi, you can hail a cab on the street, or you can call direct to Beck Cab Company, (416) 751-5555.

BUS OR TRAIN. Toronto Transit Commission (TTC) provides public-transit travel within Toronto by streetcars, buses, and subways. Day passes and single-ride tickets or tokens are sold at subway stations and some convenience stores. A family/day pass for unlimited travel is Can\$6.50 (good after 9:30 a.m. weekdays and Saturday for one adult, and Sunday for combinations of up to two adults and four children). Adult cash fare is Can\$2 and exact change is required; pick up transfers where you're boarding the vehicle.

GO Transit provides trains and buses that travel around the Greater Toronto Area (GTA) and to cities just outside the GTA. Buy day passes and tickets at stations across the city. Fares are charged according to the distance traveled. Call (416) 869-3200 for more information.

CAR RENTAL. Alamo is the official car rental agency for the meeting. Identify yourself as a GSA meeting attendee by giving Group ID number 85204 and Plan Code GR to get guaranteed, discounted, daily/weekly rates (US\$) as follows: economy \$34/\$145; compact \$38/\$160; mid-size \$42/\$175; full size \$46/\$195; convertible \$62/\$279, luxury \$70/\$329; minivan \$62/\$299. Rates include unlimited mileage. An Alamo courtesy telephone is located in the ground transportation area of Lester B. Pearson International Airport. Advance reservations are recommended. Call Alamo at 1-800-732-3232. *Note:* Parking at downtown Toronto hotels is limited and expensive. Speed limits are in kilometers per hour (for example, 100 km/h = 62 mph; 60 km/h = 37 mph).

WALKING. Below street level in downtown Toronto's financial district is a 10-kilometer network of walkways known as PATH. It winds past a multitude of shops, restaurants, and services. Don't worry about getting lost; color-coded signs provide direction.



Air Travel

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

AMERICAN (AA) AND UNITED (UA):

- Save 5% on lowest applicable fares, some restrictions apply
- Save 10% on unrestricted coach class fares, 7 day advance purchase
- Take an additional 5% off with minimum 60 day advance purchase
- Zone fares save you money with no Saturday night stay - all rules apply
- (Travel window: AA - 10/21/98 - 11/3/98, UA 10/23/98 - 11/1/98)

CANADIAN AIRLINES:

- Save 5% off any applicable fare - all rules apply
- Save 10% off full economy return fares
- Save 15% off full return business class fares
- Applicable discounts for travel within Canada are 15%-35%

YOU HAVE 3 WAYS TO MAKE YOUR RESERVATIONS

1. **Call GSA's official travel agency, CIA, direct** at 1-800-929-4242 (U.S. and Canada) and ask for **GSA Group # 633** and receive:
 - lowest available fare on any airline
 - discounts on American, United, Canadian Air
 - zone fares and bonus discounts on American and United(For reservations outside of the U.S. and Canada call (619) 453-3686)
2. **Call the airlines direct** and ask for the following codes:
American Airlines 1-800-433-1790, Starfile #9408UN
United Airlines 1-800-521-4041, Tour Code #522AN
Canadian Air 1-800-665-5554, Starfile #M02497
3. **If you use your own travel agency:**
Please refer to the ID numbers above when booking on official carriers in order to receive special discounts. (*Note: Zone fares on United are available only through United or CIA.*)

CONVENTIONS IN AMERICA

7770 Regents Road, Suite 111, San Diego, CA 92122, 1-800-929-4242, fax 619-453-7976
E-mail address: flycia@scitravel.com (Reference #633 when sending correspondence)
Web address: www.scitravel.com (Reference #633 when sending correspondence)

Visit GSA's Web site, www.geosociety.org, to browse an on-line listing of current products and services. A description and contact information are provided for each exhibitor. For information on becoming an exhibitor, contact the GSA Exhibits Manager, Tammy White, (303) 447-2020, ext. 141 or twhite@geosociety.org.

EQUIPMENT AND INSTRUMENTATION

Advanced Geosciences, Inc.
Carolina Biological Supply Company
Europa Scientific, Inc.
Finnigan MAT
Geonics Limited
Geoprobe Systems
JEOL USA, Inc.
Lane Science Equipment Corp.
Leica-Geosystems, Inc.
Magellan Corp. (Ashtech)
Micromass Canada, Inc.
Philips Electronic Instruments, Inc.
Prior Scientific, Inc.
Progigraph, Inc.
Rigaku, USA
Scintag, Inc.
Solinst Canada Ltd.
SPEX CertiPrep., Inc.
Terraplus/Georent
Thermo Instruments (Canada)
Ward's Natural Science Est., Inc.

FIELD SUPPLIES AND GEAR

Forestry Suppliers, Inc.
J. L. Darling Corporation
Wildlife Supply Company

GEOSCIENCE ASSOCIATIONS

American Geological Institute
American Geophysical Union
American Ground Water Trust
American Institute of Hydrology
American Institute of Professional Geologists
American Quaternary Association
Association for Women Geoscientists
Association of Engineering Geologists
Centre for Earth and Ocean Research
Council on Undergraduate Research, Geology Division
Cushman Foundation
Geochemical Society
Geological Association of Canada
Geoscience Information Society
International Association for Mathematical Geology
Landscapes From Stone
Mineralogical Association of Canada

National Association of Geoscience Teachers
National Earth Science Teachers Association
Paleontological Research Institution
Paleontological Society
Sigma Gamma Epsilon
Society of Economic Geologists, Inc.
Society of Vertebrate Paleontology

GEOLOGICAL SOCIETY OF AMERICA

- 1999 Annual and Section Meetings
- Bookstore
- Foundation
- Geology and Public Policy
- International Division
- Membership Services
- Planetary Geology Division
- Partners for Education (PEP) and SAGE Programs

GOVERNMENT RESOURCES

Illinois State Geological Survey
International GPS Service
NASA/Global Change Master Directory
NASA Goodard Space Flight Center/NSSDC
National Park Service
National Research Council/National Academy of Sciences
National Science Foundation
Natural Resources Canada
Oklahoma Geological Survey
U.S. Geological Survey

INSTITUTIONS

Baylor University
Desert Research Institute (DRI)
Louisiana State University
McMaster University
Ohio State University
University of Akron
University of Calgary
University of Nevada, Las Vegas
University of Nevada, Reno
University of Toronto
University of Waterloo
Wright State University

Demo Theater

Monday, October 26 through Wednesday, October 28, 9:00 a.m. to 5:30 p.m., Metro Toronto Convention Centre, Hall D

Back by popular demand! GSA is offering a unique opportunity for demonstrations of products and services at the Annual Meeting in Toronto. The theater will be located inside the exhibit hall and will feature a variety of live demonstrations, which will take place in time segments designated for these categories: Products and/or Services, CD-ROMs, Commercial Software, Shareware or Freeware. A schedule of presentations will appear on GSA's Web site in August and in the on-site *Program*.

For your name to appear in the September issue of *GSA Today* and the on-site *Program*, the deadline for presentation signups is **July 15, 1998**.

Commercial demonstrations will be charged a fee of US\$100-\$200 each time slot (multiple slots can be reserved), and you do not have to be an exhibitor to participate. Shareware and freeware developers may demonstrate for free and are encouraged to participate. If you are interested in demonstrating in any of the above categories, please contact the GSA Exhibits Manager today, while space is still available, at meetings@geosociety.org or (303) 447-2020, ext. 141, or visit GSA's Web site for information, www.geosociety.org.

LABORATORY SERVICES

Activation Laboratories, Ltd.
Geochron Laboratories
XRAL Laboratories

PUBLISHERS

AAPG Bookstore
Academia Book Exhibits
Academic Press
American Heritage Custom Publishing
American Journal of Science
Blackwell Science, Inc.
Cambridge University Press
Columbia University Press
Earth Observation Magazine
Economic Geology Publishing Company
Elsevier Science Publishing Company, Inc.
Houghton Mifflin Company
Jones and Bartlett Publishers
Kalmbach Publishing Company
Kendall/Hunt Publishing Company
Micropaleontology Press
Mountain Press Publishing Company

Oxford University Press
Plenum Publishing Corporation
Prentice Hall
Princeton University Press
Saunders College Publishing
Springer-Verlag New York
University of Chicago Press
Wadsworth Publishing Company
WCB/McGraw-Hill
W. H. Freeman and Company
John Wiley and Sons, Inc.
Yale University Press

SOFTWARE

Community of Science
Eighteen Software
ESRI
Geotectica
RockWare, Inc.
Sensors & Software, Inc.
Tasa Graphic Arts, Inc.
U.K. Earth Sciences Courseware Consortium
Universal Systems, Ltd.

GSA Headquarters Services

In addition to the regular exhibit hall hours, GSA staff will also be on hand Thursday, from 9:00 a.m. to 2:00 p.m., to provide GSA members and meeting attendees GSA services and opportunities.

GSA BOOKSTORE
GSA FOUNDATION
GSA SAGE/PEP

GSA GEOLOGY & PUBLIC POLICY
GSA MEMBERSHIP
GSA FUTURE MEETINGS

Visit Us!

CONVENIENT EXHIBIT HALL HOURS

Sunday, October 25	5:00 p.m.–7:30 p.m.
Monday, October 26	9:00 a.m.–5:30 p.m.
Tuesday, October 27	9:00 a.m.–5:30 p.m.
Wednesday, October 28	9:00 a.m.–5:30 p.m.
Thursday, October 29	Closed EXCEPT FOR

GSA HQ Services and Bookstore ➔

GSA has booked rooms at eight properties that offer special convention rates. The Sheraton Centre Toronto Hotel, headquarters for the meeting, will host most social and business events. The Delta Chelsea Inn will be the site of many of the K-16 workshops. Other participating hotels include the Royal York Hotel, Days Inn Toronto, Marriott Eaton Centre, Toronto Colony Hotel, Bond Place, and Strathcona Hotel. Most activities will take place at the Metro Toronto Convention Centre, the Sheraton, and the Delta Chelsea Inn.

To get your first choice of hotels, we highly recommend that you send your reservation in as early as possible. Convention hotels fill quickly. All hotel reservations must be processed by the GSA Housing Bureau to get the special GSA rates.

TO MAKE YOUR HOTEL RESERVATION

Fill out the housing reservation form on page 28 and either mail or fax it to the GSA Housing Bureau. (The bureau will not accept

phone calls for reservations, changes, or cancellations.) See the form for the address and fax number. If you are interested in a suite, please indicate this on your form; the bureau will contact you with availability and rates. *All reservations must be received by Friday, September 18.*

ASSIGNMENT

Hotel rooms will be assigned on a first-come, first-served basis as the Housing Bureau receives requests. Please list your first three hotel choices in order of preference. If the hotels you have chosen are full, the Housing Bureau will review your selection preference on the Housing Form. Be sure to mark which is more important to you, proximity to the Metro Toronto Convention Centre or comparable room rate. You will receive an acknowledgment from the Housing Bureau with your hotel assignment within 10 days of receipt. Check all information carefully for accuracy, including arrival date, departure date, and credit card information.

DEPOSIT INFORMATION

All reservations require a deposit equal to one-night stay plus 12% tax or a credit card guarantee. Accepted methods of payment are company check, personal check, bank check, money order, or credit card. Checks must be made payable to GSA Housing Bureau. **NOTE: Credit card information is used as a late arrival guarantee only. No deposit will be charged to the card in advance.**

CHANGES AND CANCELLATIONS

Changes to arrival or departure dates, name changes, and cancellations should be made in writing (fax is accepted) to the Housing Bureau by Friday, September 18. After this date, changes and cancellations should be made directly with the hotel. *To guarantee a full refund, cancellations should be made 48 hours prior to arrival date.*

← Payable in Canadian dollars only. US\$ estimated at 0.75 conversion rate (rate may vary up or down).

Hotel	Hotel Code	# Rooms Reserved	Rates Single/Double Can \$ and US\$	Exercise Facility	Indoor Pool	Restaurants/Lounges	Comments
1 Sheraton Centre Toronto 123 Queen Street West HEADQUARTERS <i>major international convention hotel</i>	SCT	600	Can\$144/\$164 US\$108/\$123	Yes	Yes Canada's largest	4	Business Centre, Kids & Quackers Play Centre, Toronto Tours desk. Located in the heart of downtown, connected to more than 6 miles of underground walkways (PATH), close to Eaton Shopping Centre, major city attractions, and theatre district. Voice mail, coffee maker, data ports, radio w/alarm, mini bar, irons/boards, laundry/dry cleaning.
2 Delta Chelsea Inn 33 Gerrard Street West	DEL	500	Can\$119/\$140 US\$89/\$105	Yes	Yes plus children's pool	5	K-16 Workshops, Business Centre, Children's Creative Centre, gourmet food court, ticket services. Surrounded by famous city sites, the financial district, close to headquarters hotel, Eaton Centre, and theatre district. Voice mail, radio w/alarm, coffee maker, irons/boards, laundry/dry cleaning.
3 Days Inn Toronto 30 Carlton Street	DAY	300	Can\$87/\$87 US\$65/\$65	Yes	Yes	3	Close to Eaton Centre, trolley, and theatre district.
4 Toronto Colony Hotel 89 Chestnut Street	COL	300	Can\$115/\$130 US\$86/\$98	Yes	Yes	2	Adjacent to Nathan Phillips Square, close to PATH, headquarters hotel, Eaton Centre. Voice mail, radio w/alarm, coffee pots in some rooms.
5 Bond Place 65 Dundas Street East	BON	150	Can\$104/\$104 US\$78/\$78	No	No	2	Next to Pantages Theatre, Eaton Centre, walking distance to major attractions
6 Royal York Hotel 100 Front Street West	RYL	125	Can\$155/\$179 US\$116/\$134	Yes	Yes	10	Toronto landmark, across from Union Station, connected to PATH and subway, closest to Convention Centre. Voice mail, mini bar, laundry/dry cleaning.
7 Marriott Eaton Centre 525 Bay Street	MAR	100	Can\$157/\$177 US\$118/\$133	Yes	Yes	4	Overlooking 19th-century Holy Trinity Church, connected to Eaton Centre. Voice mail, data ports, radio w/alarm, coffee maker, irons/boards.
8 Strathcona Hotel 60 York Street	STR	100	Can\$88/\$88 US\$66/\$66	No	No	2	Close to Convention Centre, SkyDome, CN Tower

All hotels have parking fees.

Note: Triple and quad occupancy rates are between \$5 and \$40 more per night per person. Some hotels restrict room occupancy to three persons. Contact GSA or the GSA Housing Bureau if you have questions on a specific property. All rates exclusive of 12% tax. Shuttle Fee: A Can\$2 per night fee is included in the hotel rate. This will be credited to the shuttle company to help defray the increasingly high cost of providing an extensive shuttle alternative for registrants. Even those registrants staying in hotels close to the Metro Toronto Convention Centre often use shuttles to get to other properties. This is a bargain compared to the price of taxis or car rental, or the alternative of even higher registration fees. We hope that with many people sharing rooms, the additional shuttle cost will be spread fairly.

SPECIAL NEEDS



The Americans with Disabilities Act and its Canadian equivalent ensure that barrier-free hotel rooms will be made available to GSA registrants. Those with special needs should specify this on the Housing Form. All properties have accessible rooms for the disabled. If you have questions or would like to know more about the accessibility of a specific hotel, please contact Kathy Lynch at GSA headquarters by September 18.

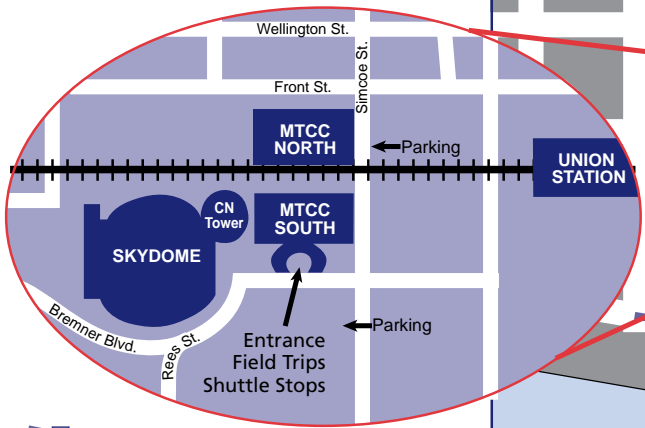
STUDENT HOUSING

No specific properties have been reserved for students. Students can reserve rooms at any of the listed properties using the housing form attached. Students interested in less expensive accommodations are encouraged to call the following for information on alternative housing.

1. Hostelling International—Great Lake, (416) 971-4440.
2. YWCA Woodlawn Residence, (416) 923-8454.

HOTEL INFORMATION

The table lists basic information on each property. The numbers correspond to the locations on the map. Your hotel invoice will be converted by your credit card company to US\$ if you are a U.S. resident, or to other currencies for other mailing addresses. For additional information, write the hotel for a brochure or contact Cathy Griswold at GSA headquarters, (303) 447-2020, ext. 133, or cgriswol@geosociety.org.



—■— Subway

- - - Harbourfront Light Rapid Transit

A MTCC: Metro Toronto Convention Centre

B CN Tower

C Skydome

Map not to scale

HOUSING DEADLINE: FRIDAY, SEPTEMBER 18.
AFTER THIS DATE CONVENTION RATES MAY NOT APPLY!

RESERVATIONS ACCEPTED BY THE FOLLOWING: *(NO TELEPHONE RESERVATIONS WILL BE ACCEPTED.)*

FAX: 416-203-6735

**Highly
Recommended**

**IF NON-CANADIAN
AIR MAIL ONLY**

Mail: GSA Housing
207 Queens Quay West
P.O. Box 126, Suite 590
Toronto, ON, M5J 1A7, Canada

Office Hours: M–F, 8:30 a.m.–5:00 p.m.

INSTRUCTIONS *(please print or type all information)*

1. An ACKNOWLEDGMENT will be sent from the Housing Bureau and a CONFIRMATION will be sent directly from the hotel.
2. Select THREE hotels of your choice from the table on page 26. Enter the appropriate hotel code in the boxes below.
3. Select type of room desired, with arrival and departure dates and times. PRINT or TYPE names of all occupants in the room.
4. One night's deposit is required with a credit card number or an enclosed check, made payable to the GSA Housing Bureau.
5. **YOUR CREDIT CARD WILL BE USED AS A LATE ARRIVAL GUARANTEE ONLY. NO DEPOSIT WILL BE CHARGED TO THE CARD IN ADVANCE.**
6. **Change and Cancellation Policy:** **Changes**—Notice of arrival or departure changes, name changes, and cancellations should be made in writing (fax accepted) to the Housing Bureau by September 18, 1998. After this date, changes and cancellations should be made directly with the hotel. **Cancellations**—To guarantee a full refund, cancellations should be made 48 hours prior to arrival date.

PLEASE PRINT

First Name: _____ MI: _____ Last Name: _____

Employer: _____

Mailing Address: _____

City: _____ State or Prov.: _____ ZIP or postal code: _____

Country: _____

Phone Number: () _____ Fax Number: () _____

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

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


TYPE OF ACCOMMODATION *(check one)*

Single (one bed, one person) Double (one bed, two people) Double/Double (two beds, two or more people)

Hotel rates quoted in Can\$—Current Tax Rate: 12%

HOTEL PREFERENCE *PLEASE SEE GRID ON P. 26 FOR PARTICIPATING HOTELS.*

First Choice _____ Second Choice _____ Third Choice _____

Smoking Nonsmoking Special needs  *(please list)* _____

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

Comparable Room Rate Proximity to Convention Centre

PLACE RESERVATION IN NAME OF: _____

Names of occupants sharing room:

GUARANTEE MY RESERVATION WITH

AMERICAN EXPRESS VISA MASTERCARD DINERS CLUB

Credit Card Number: _____ Expiration date _____

Signature: _____

(Your credit card will be used for late arrival guarantee only. No deposit will be charged to the card in advance.)



ACCESSIBILITY FOR REGISTRANTS WITH SPECIAL NEEDS

GSA is committed to making the Annual Meeting accessible to all people interested in attending. If you need auxiliary aids or services because of a disability, check the appropriate box on the registration form. If you have suggestions or need further information, contact Kathy Ohmie Lynch, GSA headquarters, (303) 447-2020, ext. 114, or klynch@geosociety.org. Please let us know your needs by *September 25*.

FAVORABLE CURRENCY EXCHANGE

The Canadian exchange rate for the past several years has been highly favorable to the U.S. dollar. As an example, the rate has been quoted at .75 in the past few months, meaning one Canadian dollar is only \$.75 in U.S. currency. This proves particularly helpful in hotel rates and other Canadian-based purchases. Credit card companies bill in your home currency and usually offer the most favorable rates, so we encourage you to use your credit cards when possible.

TAXES

Two taxes are levied on most purchases: the 8% Provincial Sales Tax (PST) and the 7% Goods and Services Tax (GST). Foreign visitors to Canada can apply for a rebate of GST paid on accommodations (up to 30 nights per visit) and on goods purchased in Canada and subsequently exported within 60 days of purchase (GST on food and beverage is not refundable). For further information or rebate forms, contact Revenue Canada, 36 Adelaide Street E, Toronto, ON, M5G 2J5, Canada, (416) 954-3400.



TOURIST INFORMATION

Tourism Toronto, Metropolitan Toronto Convention and Visitor Association, 207 Queens Quay West, Toronto, ON, M5J 1A7, Canada, (416) 203-2600, fax 416-203-6753, mtcvaadm@pathcom.com. Visit their Web site at www.tourism-toronto.com. For further information about Ontario, contact the Canadian Tourism Commission, 235 Queen St., Ottawa, ON, K1A 0H6, Canada, (613) 954-1900. Their Web site is info.ic.gc.ca/tourism.

WEATHER AND CLIMATE

Toronto's high temperatures in October range from a low of 45 °F (7 °C) to a high of 60 °F (15 °C). Come join us in Toronto and experience the wonder of a truly northeastern Technicolor autumn!

INFORMATION, MESSAGES, AND INTERNET SERVICES

Sunday, October 25 through Thursday, October 29, Metro Toronto Convention Centre

The information and message desk at the Convention Centre will be available to take messages on your behalf. Leave the following number for your home and office: (416) 585-3700.

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

NEWS ROOM

Sunday, October 25 through Thursday, October 29, Metro Toronto Convention Centre

The GSA News Room provides coordination and assembly of information on topics for release to the news media. Please let them know of material that is newsworthy for the science or general and local press. Members of the press may receive complimentary meeting registration with appropriate press credentials by contacting Sandra Rush, at rushsvcs@aol.com, or Karlon Blythe at GSA headquarters, kblythe@geosociety.org.

CHILD CARE

Saturday, October 24 through Thursday, October 29

Fees given in Canadian dollars.

Several options for child care during the GSA Annual Meeting are:

- 1. Children's Creative Centre, Delta Chelsea Inn** (*for registered guests only*). Ages 3 years (and toilet trained) to 12 years. Children can stay for up to 2½ hours maximum, twice a day, for a fee of \$5 per session per child. Hours: Monday–Thursday, 9:30 a.m.–12:30 p.m. and 1:30 p.m.–4:30 p.m.; Friday and Saturday, 9:30 a.m.–12:30 p.m. and 1:30 p.m.–10:00 p.m.; Sunday, 9:30 a.m.–12:30 p.m. and 1:30 p.m.–6:00 p.m. (416) 595-1975, ext. 4220, kidz@deltachelsea.com. Parents can go *with* their child to use the Creative Centre facilities (including children's pool) at no cost. The Delta Chelsea Inn also has a **Teen Centre** with pool table, video arcade games, and air hockey.
- 2. Christopher Robin** is a bonded, outside babysitting agency. The cost is \$35 for the first three hours (minimum), and \$8 each additional hour. They take care of children of all ages. Arrangements can be made through the Children's Creative Centre at (416) 595-1975, ext. 4220.

- 3. Kids & Quackers Play Centre, Sheraton Centre Hotel** (*for registered guests only*). Ages 18 months to 12 years. Independently managed by "Where Kids Play," experts in early childhood education. Children can stay a maximum of 4 hours per day, for a fee of \$5 per child per hour. Hours: Friday, 3:00 p.m.–11:00 p.m., Saturday, 10:00 a.m.–11:00 p.m., Sunday, 10:00 a.m.–4:00 p.m. (416) 947-4942.

Please note: Hours of operation and fees may change. Parents are encouraged to contact one of these services for further information and/or interviews. GSA is not recommending one child care service over another.



Downtown Toronto. Sheraton Centre Hotel (center left), new City Hall (center right) —Courtesy of Metropolitan Toronto Convention and Visitors Association.

PREREGISTRATION FORM TORONTO October 26-29, 1998

GSA ANNUAL MEETING • TORONTO, ONTARIO Preregistration Deadline: September 18. Deadline for changes or cancellation is September 25.

Please print clearly • THIS AREA IS FOR YOUR BADGE

* Male Female

Name (last) First name/nickname (as it should appear on badge) Employer/University (affiliation as it should appear on badge)

Mailing address for Employer/University above

City State or Province ZIP or Postal Code E-mail

Country (other than USA) Business Phone Fax Home Phone

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

City/State Country (other than USA)

Do you or your guest require any special considerations? Will you be working in the exhibit hall? For CEU credit - Social Security #

Check member affiliation (to qualify for registration member discount): (a) GSA (b) AASG (c) AASP (d) AEG (e) AGID (f) AIPG (g) AWG (h) CF (i) IJOUR (j) GIS (k) GS (l) MSA (m) MABGG (n) MAGT (o) NESTA (p) PS (r) PRI (s) SEG (t) SGE (u) SVP (v) GAC (w) IMAC

REGISTRATION FEES (US\$) Table with columns: Registration Fee, Full Meeting, One Day, Qty., US\$ Amount. Includes rows for Professional Member, GSA Member, Nonmember, Student, K-12, Guest or Spouse, Field Trip or Short Course Only Fee.

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

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

Remit in U.S. funds payable to: 1998 GSA Annual Meeting (All preregistrations must be prepaid. Purchase Orders not accepted.)

Payment by (check one): Check American Express VISA MasterCard

Card Number Signature Expires

GUEST EVENTS

Table with columns: Event Name, US\$ Amount. Includes Bird Watching, Chiasm of Niagara, Chinatown City Tour, Toronto City Tour, Niagara Falls Wine/Lunch, Visit the Sky, Don Valley Brick Works, McMichael Gallery, Day in the Country, Luncheon-Cooking Forum, Six Hour Shoppers Shuttle, Art Gallery of Ontario, High Tea—King Edward Hotel.

SPECIAL EVENTS

Table with columns: Event Name, US\$ Amount. Includes Toronto Symphony, Dinner, PATH Walking Tour, ROM Wine & Cheese Reception, Pub Crawl.

TICKETED GROUP FUNCTIONS

Table with columns: Event Name, US\$ Amount. Includes G&PP Breakfast, Geosci. Ed. Div. Breakfast, MAGT Lunch, AWG Breakfast, History Geol. Div. Lunch, Hydrogeol. Div. Lunch, MSA Lunch, Paleont. Soc. Lunch, SEG Lunch, MSA/GS Recept., Eng. Geol. Div. Lunch, GIS Lunch.

FIELD TRIPS

Table with columns: Trip Name, US\$ Amount. Includes Transsect of Grenville Province, Western Quebec Grenville, Postglacial Surface Proc., Allochthonous Controls, Bancroft-Haliburton-Muskoka, Black R. and Trenton Limestone, Niagara Falls, Quatern. Geol. Sites, Niagara Falls (Postmeeting), Quatern. Geol. Sites (Postmeeting), Grouardwater Experimental Sites, Chert, Corn, Environ. Change, Hydrogeol./Late Quat. History, Extension & Vertical Thinning, Oak Ridges Moraine, Stratigraphy of Niagara Escarpment.

K-16 PROGRAMS

Table with columns: Program Name, US\$ Amount. Includes Multicultural & Interdisciplinary, Dufferin Aggregates Quarry, Exploring the Solar System, Innovative/Effective Teaching, Undergrad. Research Programs, Learning from Fossil Record, IDIG Forum, More Innov./Effective Teaching, Canadian Educ. Symposium, Directing Undergrad. Research, Mineral Crystal Clusters, Gold Diggers' Days, ROM School Programming, Oceanography Workshop, EarthComm Workshop, Share-a-thon Presenters Only.

SHORT COURSES

Table with columns: Course Name, US\$ Amount. Includes Analysis of Veins, Deformation Mechanisms & Microstructures, Phase I Environmental Site Assessments, 3-D Seismic Interpretation: Primer for Geologists, Analytical Methods & Applications, Applications of Environmental Isotopes, Buck Rogers: Field Geologist, Design & Creation, Detecting Environmental Effects, Time Domain Reflectometry, Teaching Practical Hydrogeology.

Total Column C Total Column B Total Column A

TOTAL FEES REMITTED US\$

BY MAIL



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

BY FAX



303-447-0648 or
303-447-1133
Available 24 hours.
Credit card use only.

Please do not send another copy in the mail.

All registration forms received at GSA by September 18 will be processed and badges mailed two weeks before the meeting.

GSA, Associated Society, and GAC/MAC members SAVE US\$40 (professional) and US\$20 (student) with preregistration fees.

Nonmembers save an additional US\$40 (professional) and US\$20 (student) by joining GSA now. See how to get your discount below.

Preregistration deadline:
SEPTEMBER 18

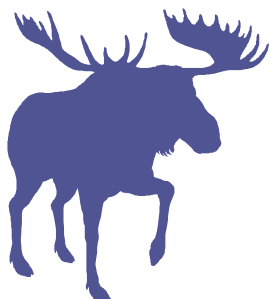
Cancellation deadline:
SEPTEMBER 25

The member fees apply to members of both GSA and Associated Societies (listed on the form). *For the 1998 meeting, GSA welcomes all Geological Association of Canada and Mineralogical Association of Canada members under the Associated Societies rate.*

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

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

A *guest registration* fee is available for a nongelologist spouse or friend of a professional or student registrant and is required for those attending guest activities and the exhibit hall. The guest registration fee will not provide technical session access. Any guest wishing to see a



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specific talk should come to the preregistration desk for a pass.

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

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

All registrations received after September 18 will be considered on-site registrations and charged accordingly. Absolutely no registrations should be mailed or faxed after October 2. After this date we will handle registrations at the Convention Centre during the registration hours listed below. **There will be on-site counters for transactions in Canadian currency.**

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

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

CANCELLATIONS, CHANGES, AND REFUNDS

All requests for additions, changes, and cancellations must be made in writing and received by September 25, 1998. Faxes are accepted.

GSA will refund or credit preregistration fees for cancellations received in writing by September 25. *No refunds will be made on cancellation notices received after this date.*

Refunds will be mailed from GSA after the meeting. Refunds for fees paid by credit card will be credited according to the card number on the preregistration form. There will be *no* refunds for on-site registration, *Abstracts with Programs*, and ticket sales.

ON-SITE REGISTRATION SCHEDULE

Metro Toronto Convention Centre, Level 600

Saturday, Oct. 24 7:00 a.m. to 4:30 p.m.
Sunday, Oct. 25 7:00 a.m. to 7:30 p.m.
Monday, Oct. 26 7:00 a.m. to 4:30 p.m.
Tuesday, Oct. 27 7:00 a.m. to 4:30 p.m.
Wednesday, Oct. 28 7:00 a.m. to 4:30 p.m.
Thursday, Oct. 29 7:00 a.m. to 11:00 a.m.

MEMBERS PAY LESS! JOIN NOW!

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

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

REGISTRATION FEES

All fees are in U.S. dollars.

	Full Meeting	One Day	On-Site
	Advance—by 9/18/98		After 9/18/98
Professional Member	\$220	\$136	\$270
Professional GSA Member (70 or older)	\$170	\$ 86	\$220
Professional Nonmember	\$270	\$161	\$320
Student Member	\$ 80	\$ 53	\$105
Student Nonmember	\$105	\$ 66	\$130
Guest or Spouse	\$ 80		\$ 80
K-12 Professional	\$ 30		\$ 40
Field Trip or Short Course Only	\$ 35		\$ 35

1998 Annual Meeting

ABSTRACTS DUE JULY 13

PREREGISTRATION & HOUSING DUE SEPTEMBER 18
(Registration and Housing forms enclosed)

CANCELLATION: SEPTEMBER 25

WORLD WIDE WEB

Visit the GSA Web site to view more details and to get the latest information on short courses and field trips.

www.geosociety.org

GSA DIVISIONS

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

ASSOCIATED SOCIETIES

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

INFORMATION

Call: (303) 447-2020 • 1-800-472-1988 ■ Fax: 303-447-0648
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1998, Volume 30, Number 7

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

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

By mail or fax, use the form provided.
By phone, call toll-free 1-800-472-1988, ext. 152, or use our business phone (303) 447-2020 during office hours (8:00 a.m. to 4:30 p.m. MT).

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Copies of *Abstracts with Programs* will be for sale in the registration area of the Metro Toronto Convention Centre.

Note: Your registration does not include a copy of the *Abstracts with Programs* volume.