

# ***BARBARA SHERWOOD LOLLAR***

## **CURRICULUM VITAE**

### **A. BIOGRAPHICAL INFORMATION**

#### ***1. PERSONAL INFORMATION***

Office:	Home:
22 Russell St. Department of Geology	57 Wolverleigh Blvd
University of Toronto	Toronto M4J 1R6
Toronto, Ont. M5S 3B1	Tel: (416) 778-4548
Tel: (416) 978-0770	Fax: (416) 978-3938
email: bsllollar@chem.utoronto.ca	

Citizenship: Canadian  
Languages: English, French

#### ***2. DEGREES***

1985: B.A. (Honours - Geological Sciences)  
Summa cum laude  
Harvard University

1990: Ph.D. (Earth Sciences)  
University of Waterloo

#### ***THESES:***

Sherwood Lollar, B., 1990. Origins and Implications of Methane in the Crystalline Environment - the Canadian and Fennoscandian Shields, Ph.D. thesis, Dept. of Earth Sciences, University of Waterloo, Waterloo, Ontario, 402 p. Supervisors: Drs. P. Fritz and S.K.rape.

Sherwood, B.A., 1985. Phosphorus in Foraminiferal Sediments from North Atlantic Ridge Cores, Bachelor's thesis, Dept. of Earth and Planetary Sciences, Harvard University, Cambridge, MA, 51 p.  
Supervisor: Dr. H.D. Holland.

#### ***3. EMPLOYMENT HISTORY***

2001-present Professor, Dept. of Geology and Director, Stable Isotope Laboratory

1999-present Adjunct Professor, Dept. of Chemistry, University of Toronto

1996-2001 Associate Professor, Dept. of Geology and Director, Stable Isotope Laboratory

1996 Awarded Tenure

1995 Appointed to the Graduate Faculty - School of Graduate Studies

1992-1996 Assistant Professor, Dept. of Geology and Director, Stable Isotope Laboratory  
University of Toronto

1990-92 NSERC Postdoctoral Fellow  
Supervisor: Dr. R.K. O'Nions  
Dept. of Earth Sciences, University of Cambridge, U.K.

## EXECUTIVE SUMMARY

Director of the Stable Isotope Laboratory, Professor in Geology since 1992, B. Sherwood Lollar has been a leader in the innovative use of compound specific stable isotope techniques to track the source and fate of organic contaminants in groundwater, in the investigation of the source and fate of CO<sub>2</sub> in sedimentary basins and natural carbon sequestration analog settings, and in the identification of subsurface gases (methane and hydrogen) in deep (2-3 km) groundwaters in the oldest rocks on earth and the biogeochemical cycling by deep subsurface microbial communities. Dr. Sherwood Lollar has published more than 100 peer-reviewed articles (two of which have been featured on the cover of *Nature*; 2002; 2009), and lectured in academic settings, public lectures and policy workshops for regulators and legislators. She is the Editor for one of the most successful volumes (Vol. 9 Environmental Geochemistry) in the award-winning major reference work *Treatise on Geochemistry* published by Elsevier in 2003 and is an Editor-in-Chief for *Chemical Geology*. Most recently she has lectured at Harvard University, Stanford University, Carnegie Institute of Washington, Notre Dame, NASA, UNESCO, the International Atomic Energy Agency (IAEA), and the Bacon & Eggheads public lecture series for Members of Canadian Parliament and Senators. She has served as a Board member for the Natural Sciences and Engineering Research Council of Canada (NSERC) (2003-2011), as Chair of the NSERC Research Grants and Scholarships Committee (2008-2010); the Governing Council of the University of Toronto (on Executive Board for 2005-2007), and the Board of Directors for the Center for Environmental Science and Technology at Notre Dame University (2003-2006). She serves on advisory committees for the Canadian Space Agency (2006-2009), the Canadian Mining Industry Research Organization (CAMIRO) (2006-2010), and the U.S. National Academy of Sciences Space Studies COEL Committee (2005-2011) and as a member of the Board of Trustees for the Ontario Science Centre (2007-2011).

Applications of her work include the development of new techniques for using stable isotope tracers to determine the fate and distribution of organic contaminants in near surface groundwaters and the effectiveness of groundwater remediation systems in cleaning up contaminated sites. In this area of her research Sherwood Lollar's group has collaborated extensively with industrial partners, consultants and regulators in both Canada and the United States. The impact of this work in water quality can be measured not only in terms of academic awards (Darcy Lecture, Steacie and Killam Awards, Royal Society), prestigious invited lectures and research grants, but in industrial partnerships and input on water quality issues, contamination of groundwater resources and carbon capture and storage issues given to regulatory agencies in Canada, the United States (MOE, EPA, DOE), and abroad (International Atomic Energy Agency). Based on her research in environmental quality, *TIME Magazine* (see below) profiled her as one of 25 "Leaders for the 21<sup>st</sup> Century" in 2000. In addition to research impact, the Stable Isotope Laboratory at the University of Toronto is closely involved with industrial partners and regulators in the commercialization, technology transfer and application of novel isotopic techniques for solving environmental problems in the marketplace.

## 4. ACADEMIC AWARDS AND HONOURS

University Professor, University of Toronto	2010
Senior Fellow, Massey College, University of Toronto	2010
Chemical Geology Top 10 Most Highly Cited Papers in 2005-2010	
SERDP Environmental Restoration Project-of-the-Year Award Presented to Dr. Barbara Sherwood Lollar (Toronto), E. Edwards (Toronto) J. Gossett (Cornell), J. Spain (Georgia Tech) and E. Cox (GeoSyntec Ltd) Partners in Environmental Technology Technical Symposium & Workshop	2010
NSERC Accelerator Award	2008-2011
Canada Research Chair Tier I Isotopes of the Earth and Environment	2007-2014
American Chemical Society Division of Environmental Certificate of Merit for Presentation at Annual Spring Meeting Elsner et al. (2007) Probing oxide surface reactivity using stable isotope fractionation"	2007
Royal Society of Canada WISSET Lecturer to Japan	2007
Fellow of Royal Society of Canada	2004

Canada Council Killam Research Fellowship	University of Toronto	2004-2006
<b>TIME</b> Magazine - Canada Edition - Profiled as one of 25 “Leaders for the 21 <sup>st</sup> Century”		2000
NSERC EW.R. Steacie Fellowship	University of Toronto	1999-2001
Henry Darcy Distinguished Lecturer in Hydrogeology	U.S. National Groundwater Association Association of Ground Water Scientists and Engineers (AGWSE)	1998
NSERC Postdoctoral Fellowship	University of Cambridge	1990-92
Governor-General's Gold Medal for PhD	University of Waterloo	1990-91
W.B. Pearson Medal in Earth Sciences for PhD	University of Waterloo	1990-91
J.H. Stewart Reid Memorial Fellowship	University of Waterloo	1989-90
Petro-Canada Inc. Graduate Research Award	University of Waterloo	1987-89
NSERC Postgraduate Scholarship	University of Waterloo	1985-89
University of Waterloo Graduate Scholarship	University of Waterloo	1985-86

## 5. PROFESSIONAL AFFILIATIONS AND ACTIVITIES

### *Public Consultation and Technology Transfer*

B. Sherwood Lollar and T. Buscheck (Chevron) Co-Chairs and Organizers - Special session on **Compound Specific Isotope Investigations at Contaminated Field Sites**. Battelle International Symposium on Bioremediation and Sustainable Environmental Technologies, Reno, NV. June 2011.

B. Sherwood Lollar. Panelist. **Biogeochemical Transformation Processes**. Battelle International Symposium on Bioremediation and Sustainable Environmental Technologies, Reno, NV. June 2011.

B. Sherwood Lollar. **Extending the reach for monitoring microbial activity with CSIA**. REMTEC Remediation Technology Transfer Workshop. Keynote. Chicago. May 2011.

B. Sherwood Lollar. **CSIA for Forensic Investigations: Potential, Practicalities and Pitfalls**. Presentation to ENVIRON Corporation. Mississauga ON. April 2011

B. Sherwood Lollar. **Lessons from the Earth on Carbon Capture and Storage**. Presentation to CIBC Wood Gundy. April 2011. Toronto ON

**Groundwater Resources Association Conference on Environmental Forensics**. Presentation S. Mancini (Golder Associates), B. Sherwood Lollar and G. Lacrampe-Couloume (University of Toronto). Differentiating multiple sources of organic contaminants using compound specific carbon and hydrogen isotope analysis. April 2011. California.

B. Sherwood Lollar. **Emerging Research in Astrobiology in Canada**. Council of Ontario Universities. Canada Research Chairs 10<sup>th</sup> Year Anniversary Symposium. Toronto ON. Nov. 2010

**Natural Sciences and Engineering Research Council of Canada** “Maximizing Opportunities” Increasing Women’s Participation in Science and Engineering – A Summit. Ottawa ON. Nov. 2010

B. Sherwood Lollar and P. Philp. Compound Specific Isotope Analysis for Forensic Investigations and Environmental Clean-up. United

States Environmental Protection Agency (EPA) Technology Innovation and Field Services Division "Contaminated Site Clean-up Information" Web-based Internet Seminar. October 2010.

B. Sherwood Lollar. Compound Specific Analysis for Forensic Investigations: Potential, Practicalities and Pitfalls. Invited Presentation. United States Air Force Restoration and Technology Transfer Workshop on Groundwater Contamination. San Antonio TX. April 2010.

B. Sherwood Lollar. **Isotopic constraints on chlorobenzene biodegradation and remediation at contaminated field sites. Presentation** to Chambers Works Science Advisory Board. DuPont. Wilmington DE. March 2010.

Minister of Natural Resources Honourable L. Raitt Invited Round Table on Clean Energy Research and Development - Fossil Fuels. Invited Panelist for discussion. Nov. 6, 2009. Calgary AB.

Canada Research Chairs Secretariat and University of Western Ontario Invitational Meeting and Round Table - Canada's Energy Future. Invited Panelist and Speaker on Long-term Viability/Sustainability of Conventional Energy Sources - Carbon Capture and Storage Options - October 20, 2009 - Ottawa ON.

Munk Centre of International Studies at the University of Toronto - Program on Water Issues - Burying Carbon Dioxide in Underground Saline Aquifers: Political Folly or Climate Change Fix? Invited Panelist for discussion. Sept. 23, 2009. Toronto ON.

Public Policy Forum - Science Day in Canada - Invited Panelist for discussion on release of the Science, Technology and Innovation Council (STIC) of Canada report on the State of Science, Technology and Innovation in Canada. May 27, 2009. Ottawa ON.

B. Sherwood Lollar and X. Liang - "Potential Role of Compound Specific Isotope Analysis (CSIA) and Other Tools in Measuring *In Situ* Biogeochemical Transformation". In Situ Biogeochemical Transformation Workshop U.S.E.P.A. Environmental Protection Agency Workshop. Dallas Texas. Nov. 2009.

M. Davidson (GeoSyntec International), D. Major (GeoSyntec International), B. Sherwood Lollar (U. of Toronto) and E.A. Edwards (U. of Toronto). Webinar for General Electric on "Compound Specific Isotope Analysis: A primer for applications to contaminant remediation". Sept. 2009.

B. Sherwood Lollar, and S. Hirschorn. "Compound Specific Isotope Analysis: A primer for applications to contaminant remediation". One day workshop for GeoSyntec Consultants Inc. and Sirem Ltd. Toronto Ontario. June 2006.

B. Sherwood Lollar and C.M. Aelion "Tools/Techniques for Chlorinated Solvent Sites". Half day workshop at Battelle 8<sup>th</sup> International In Situ and On Site Bioremediation Symposium Baltimore, MD. June 2005.

B. Sherwood Lollar. "Use of stable isotopes to evaluate contaminant degradation". One day workshop for Central New York Association of Professional Geologists Symposium on Isotopic Geochemistry. Skeneatales NY. April 2005.

B. Sherwood Lollar, R. Meckenstock, T. Schmidt, J. Wilson and D. Hunkeler. Applications of Compound Specific Isotope Analysis (CSIA) to contaminant biodegradation. Workshop and white paper development for IAEA International Atomic Energy Agency and U.S. Environmental Protection Agency. Vienna Austria. October 2005.

B. Sherwood Lollar. "Use of Compound Specific Stable Isotope Techniques for Quantification of Biodegradation Rates". UNESCO Workshop on Transport and Fate of Diffuse Organic Contaminants in Catchments. GSF-Research Centre for Environment and Health, Munich Germany. Dec. 2004

B. Sherwood Lollar. "Stable Isotope Forensics: Promise and Pitfalls". Golder Associates Inc. Symposium on Innovative Strategies for Management of Contaminated Sites. Toronto, ON. Nov. 2004.

#### ***Activities as Editor***

Editor-in-Chief *Chemical Geology* (Jan 2010 to present) - One of the top most highly cited disciplinary journals in field of isotope geochemistry.

Member of Advisory Board for *ELEMENTS: International Magazine of Mineralogy, Geochemistry and Petrology*.

Volume Editor for **Volume 9: Environmental Geochemistry** of 10 volume series *Treatise in Geochemistry* by Elsevier Scientific Publishing. Published 2003.

Editors-in-Chief - Dr. H.D. Holland (Harvard University) and Dr. K. Turekian (Yale University)

May 2005 paperback Edition of *Treatise on Geochemistry Volume 9: Environmental Geochemistry* published and over 1200 copies sold. Revised second edition of web version work completed April 2006.

Editor of Special Volume 30 in **Organic Geochemistry**

"Compound-Specific Isotope Analysis: Tracing Organic Contaminant Sources and Processes in Geochemical Systems" October 1999.

Associate Editor (1998-2003) **Ground Water** - Scientific Journal with one of largest circulations of any of the hydrogeology, hydrogeochemistry journals. Subscription circulation of over 19,000, 20% of which is outside North America.

### ***Work on Research Program Peer Review Panels, Prize Committees and Academic Organizations***

Executive Committee - Sloan Foundation - Carnegie Institution of Washington Deep Carbon Observatory (2011-2012)

NASA/ESA Joint Science Working Group (JSWG) 2018 Joint Rover Mission to identify and prioritize scientific objectives for 2018 Joint Mars Rover Mission. (David Beaty NASA Mars Program Office -JPL and Gerhard Kminek, ESA-ESTEC) Co-chairs. (2011-2012)

NASA Mars Exploration Program Advisory Group (MEPAG) E2E-iSAG committee) to identify and prioritize scientific objectives for 2018 Mars Rover Mission. Scott McLennan (Stonybrook, NY) and Mark Sephton, (Imperial College, UK) Co-chairs. (2010-2011)

Geochemical Society – The V.M. Goldschmidt Career Award Selection Committee 2010-2013

Advisory Board and Visiting Scientist for European Union Marie Curie Training Network in Isotope forensics and biogeochemistry -“CSI: Environment” 2010-2014.

NSERC Strategic Program Sub-Topic Focus Group Chair 2010

NASA Mid-Range Rover Science Analysis Group (MRR-SAG 2009) working under MEPAG (Mars Exploration Program Science Group) to identify and prioritize scientific objectives for 2018-2020 next generation Mars Rover

Canadian Space Agency (CSA) Mars Sample Return Analogue Mission Definition Team 2009

Ontario Science Centre Weston Youth Innovation Award Prize Committee 2009 and 2010

Royal Society of Canada - Committee for Selection of New Fellows 2008-2010

Geochemical Society - Organic Geochemical Division Treibs Award Selection Committee 2008-2011

Ontario Science Centre Board of Trustees 2007-2010; Chair of Long-term Experience Committee (2008-2010)

Council of Canadian Academic Expert Panel on Groundwater 2007-2008

Executive Program Committee Co-Chair - Goldschmidt 2008 Vancouver, BC July 2008

Natural Sciences and Engineering Council of Canada (NSERC) Council 2003-2010

NSERC Executive Committee 2005-2006 and 2007-2010

NSERC Committee on Research Grants and Scholarships 2006-2010 (Chair 2008-2010)

NSERC Chair of Committee on Research Integrity (2008-2010)

Canadian Space Agency - Space Exploration Advisory Committee 2006-2009

Partnership Group for Science and Engineering (Royal Society of Canada) 2006-2007

Communications Committee correspondent-at-large for *Bacon and Eggheads* Lecture Series for Parliament

CAMIRO (Canadian Mining Industry Research Organization) Geochemistry Expert Committee 2006-2009

United States National Research Council National Academies of Science 2005-2012  
Committee on the Origin and Evolution of Life (Space Studies Board/Life Sciences Board)

Canadian Water Network Expert Panel Review - Jan. 2007

U.S. Strategic Environmental Research and Development Program (SERDP)/ Environmental Security Technology Certification Program (ESTCP) and the US EPA Summit on Future Research Directions on Biogeochemical Processes in the Degradation of Chlorinated Solvents.  
San Antonio TX April 2007

Chair NSERC Prize Committee - Herzberg Gold Medal 2005

Chair NSERC Prize Committee - Brockhouse Prize 2005

NASA Astrobiology Review Panel for NAI Cooperative Agreement Notice (CAN-4)  
Sub-Panel Chair 2005

International Atomic Energy Agency panelist (one of 5) on development of  
White Paper for the use of Compound Specific Isotope Analysis (CSIA) October 2005  
White paper to be published as joint publication from IAEA and U.S. Environmental Protection Agency

NSERC Strategic Program Sub-Topic Focus Group 2005

U.S. Strategic Environmental Research and Development Program (SERDP)/ Environmental Security Technology Certification Program (ESTCP) Workshop on Molecular Biological Tools  
Charlottesville VA Aug. 2005

Board of Directors - Centre for Environmental Science and Technology - University of Notre Dame 2003-2006

International Geochemical Society C.C. Patterson Medal Selection Committee 2002-2004

CRESTech - Land Resources Grant Review Panel 2002-2004

Natural Sciences and Engineering Council of Canada (NSERC) Circle  
Advisory Panel for NSERC 2001-2004

Nomination Committee for Henry Darcy Distinguished Lecture Series for 1999-2002

Selection Committee for Geological Society of America Meinzer Award 1999-2001

Nominations Committee for the Organic Geochemistry Division  
The Geochemical Society 1997-2000 (Chair for 1999); 2004-2006

IsoTrace Accelerator Mass Spectrometry Laboratory - University of Toronto  
Executive Committee - Board of Directors 1995-2002

Natural Sciences and Engineering Council of Canada (NSERC)  
Review Panel for NSERC Strategic Partnerships Program  
1997-1999

Natural Sciences and Engineering Council of Canada (NSERC)  
Review Panel for NSERC Multi-Facilities Access Program 1999

U.S. Department of Energy Stocktaking Panel - Natural Accelerated Bioremediation Research  
Oyster Stocktaking Meeting - Virginia Beach, VA - 1999

Organizing Committee for Geological Society of America Annual Meeting 1998 - Toronto

External Scientific Review 1995 - Environmental Protection Agency  
National Exposure Research Laboratory - Ecosystems Research Division - Internal Grants Program

Scientific Review Panel 1994 - U.S. Dept. of Energy - Subsurface Science Program  
Deep Microbiology and Microbial Ecology Subprogram

## B. RESEARCH AWARDS

*Held as Principal Investigator*

	TOTAL AMOUNT	DATE/DURATION
<b>Sloan Foundation Deep Carbon Observatory</b> Title: Reduced Carbon in Earth's Crust and Mantle: I. Abiogenic versus Biogenic Origins PI: D. Cole and C.J. Ballentine Subteam PI: B. Sherwood Lollar (Toronto) Co-PIs: E. van Heerden (Univ. of Free State, SA); T.C. Onstott (Princeton); M. Itavaara (VTT, Finland)	\$1,500,000 (BSL portion \$320,000)	2011-2013
<b>NWMO (Nuclear Waste Management Organization) Research Grant</b> Title: Characterization of Subsurface Biogeochemical Processes relevant to a Deep Geologic Repository PI: B. Sherwood Lollar Co-PIs: G.F. Slater (McMaster) and D. Moser (Desert Research Institute)	\$420,000	2011-2014
<b>NWMO (Nuclear Waste Management Organization) Research Grant</b> Title: State of Science: Far-field Microbiological Considerations relevant to a Deep Geological Repository for used nuclear fuel PI: B. Sherwood Lollar	\$75,000	2009-2010
<b>GeoSyntec Ltd.</b> Title: Investigations for Potential for in situ biodegradation at a contaminated field sites using CSIA PI: B. Sherwood Lollar	\$7,200	2010-2011
<b>NSERC Strategic Grant</b> Title: Investigation of CSIA as an Innovative Quantitative Tool for Performance Assessment of Groundwater Remediation at Contaminated Sites PI: B. Sherwood Lollar Co-PIs: E. Edwards (Chem. Eng) and B. Sleep (Civ Eng) S. Desrocher (ENVIRON Canada Inc.) and S. Dworatzek (SiREM Inc.) Industry Partner Matching funds: ENVIRON Canada Inc. SiRem Ltd.	\$450,000    \$10,000 \$18,000	2009-2012    2009-2011 2009-2011
<b>NSERC Discovery Accelerator Grant</b> Title: H <sub>2</sub> and CH <sub>4</sub> from Precambrian Shield Rocks and Microbiological Sinks for Gases produced by Water-Rock Interactions: Energy for the Deep Biosphere	\$120,000	2008-2011
<b>NSERC Discovery Grant</b> Title: H <sub>2</sub> and CH <sub>4</sub> from Precambrian Shield Rocks and	\$257,750 (\$51,550 pa)	2008-2013

Microbiological Sinks for Gases produced by Water-Rock Interactions:  
Energy for the Deep Biosphere

**NSERC Special Research Opportunities Grant** \$350,000 2006-2008

Title: Tracers in the Deep: Testing for chemoautotrophic microbial communities in the Precambrian Shield deep subsurface

PI: B. Sherwood Lollar

Co-PIs: G.F. Slater (McMaster), E. Edwards (Chem-Eng, Toronto)

**GeoSyntec Consultants International Ltd. Research Grant** \$21,000 2007-2008

Title: Use of stable carbon isotope analysis to evaluate in situ biodegradation of chlorobenzenes under aerobic and anaerobic conditions

PI: B. Sherwood Lollar

Co-PI: E.A. Edwards (Univ. of Toronto)

**NSERC CRD Grant** \$26,000 2007-2008

Title: Application of stable isotope analysis as a quantitative tracer of bioremediation of aromatic hydrocarbons in heterogeneous aquifers

Co-investigator: E.A. Edwards (Univ. of Toronto)

Industry partner: NOVA Chemicals (see below)

**NOVA Chemicals Research Grant** \$36,720 2006-2008

Title: Use of stable carbon and hydrogen isotope analysis to evaluate the performance of biostimulation of benzene

PI: B. Sherwood Lollar

**NSERC Research Tools and Instruments** \$39,515 2006

Title: Purge and Trap Concentrator for detection of hydrogen and oxygen compound specific isotope analysis

Co-PIs: M. Simpson (UTSC), A. Simpson (UTSC), Edwards (Chem-Eng)

**Canadian Space Agency Analogue Site Studies** \$39,750 2006-2008

Title: Deep crustal fluids in the Canadian Shield: analogues for deep subsurface habitats on Mars

Co-PIs: G.F. Slater (McMaster); E. Edwards (Toronto)

**NSERC Research Tools and Instruments** \$129,422 2005

Title: Dedicated nuclear magnetic resonance probe for the detection of site-specific natural isotopic fractionation (SNIF)

Co-PIs: M. Simpson (UTSC), A. Simpson (UTSC)

**NSERC Collaborative Research Development Grant** \$52,000 2005-2007

Title: Use of Stable Isotopes to Evaluate the Performance of Nanoparticulate Iron in Remediation of Chlorinated Hydrocarbon Contamination: Field and Laboratory Studies

\*Matching funds to Golder Associates Ltd. Grant

**\*Golder Associates Ltd. Research Grant** \$30,000 2005-2007

Title: Use of Stable Isotopes to Evaluate the Performance of Nanoparticulate Iron in Remediation of Chlorinated Hydrocarbon Contamination: Field and Laboratory Studies

**Canadian Space Agency Advanced Studies** \$350,000 2003-2008

Title: Biosustainable Energy and Nutrient Cycles in the Deep Subsurface of Earth and Mars

PI: B. Sherwood Lollar

<b>NSERC Discovery Grant</b> Title: Hydrocarbons in transition zones in dynamic field settings includes \$10,000 Northern Supplement for 2006-2008	\$262,750	2003-2008
<b>FNX Mining Inc.</b> Title: Investigation of isotopic analysis of fluid inclusions	\$17,000	2003-2005
<b>GeoSyntec Consultants International - Boston, MA</b> Title: MTBE biodegradation investigated through the use of stable carbon isotopes	\$11,520	2003-2004
<b>GeoSyntec Consultants International - Boston, MA</b> Title: Environmental isotopes as tracers of contaminant degradation - VC	\$16,000	2002-2003
<b>NSERC Collaborative Research Development Grant</b> Title: Applications of stable carbon isotopes to monitoring intrinsic bioremediation of aromatic hydrocarbons Co-investigators: B. Sleep (Civ. Eng. U. of Toronto) E. Edwards (Chem. Eng. U of Toronto)	\$ 50,660	2001-2003
<b>American Association of Petroleum Geologists</b> Grants-in-Aid of Field Research Support to J. Gray	\$2,000	2002-2003
<b>NSERC Strategic Grant</b> Title: Environmental Isotope as Tracers of Contaminant Degradation - Integration of an Innovative New Technology, Compound Specific Hydrogen Isotope Analysis Co-investigators: B. Sleep (Civ. Eng. - U. of Toronto) E. Edwards (Chem. Eng. - U of Toronto) S. Mabury (Chemistry - U. of Toronto) * Grants indicated * below are the industry matching funds for this Strategic Project	\$459,150	2001-2005
<b>Geosyntec Consultants International Ltd.</b> *Industry research matching funds for NSERC Strategic Project 2001-2005	\$ 24,000	2001-2005
<b>United Technologies Corporation</b> *Industry research matching funds for NSERC Strategic Project 2001-2005	\$ 18,000	2001-2003
<b>Environmental Science and Technology Alliance Canada</b> Title: Use of carbon isotope signatures as tracers of intrinsic remediation of aromatic hydrocarbons Co-investigators: B. Sleep (Civ. Eng. U. of Toronto) E. Edwards (Chem. Eng. U of Toronto)	\$111,460	2000-2002
<b>Applied Groundwater Research Ltd.</b> *Industry research matching funds for NSERC Strategic Project 2001-2005	\$ 5,000	2001-2002
<b>Envirometal Inc.</b> *Industry research matching funds for NSERC Strategic Project 2001-2005	\$ 12,000	2001-2002

<b>TAUW Research and Development Department The Netherlands</b>	\$31,000	2000-2001
Title: Application of isotope analysis for soil pollution research		
<b>NSERC Individual Research Grant</b>	\$160,000	1999-2003
Title: Isotopic constraints on the source, transport and transformation of natural and contaminated compounds in shallow and deep groundwaters		
<b>NSERC EWR Steacie Fellowship Supplement</b>	\$193,900	1999-2001
Title: New developments in hydrogen isotope geochemistry applied to shallow and deep groundwater systems		
<b>NSERC Major Equipment Grant</b>	\$257,015	1999-2000
Title: Gas Chromatograph Isotope Ratio Mass Spectrometer (GC/C/IRMS) for continuous flow high sensitivity analysis of H and N isotopes		
PI: B. Sherwood Lollar		
Co-investigators: B. Sleep (Civ. Eng. U. of Toronto)		
E. Edwards (Chem. Eng. U of Toronto)		
S. Mabury (Chemistry, U. of Toronto)		
J. Brenan (Geology, U. of Toronto)		
J. Stix (Geologie, U. of Montreal)		
D. Muir (Canadian Centre for Inland Waters)		
R. Therrien (Geologie, Laval)		
<b>NSERC Equipment Grant</b>	\$34,456	1999-2000
Title: Gas Chromatograph for low level H <sub>2</sub> compositional analysis		
<b>Imperial Oil University Research Grant</b>	\$30,200	1998-2001
Title: Stable Carbon Isotopes: Tracers of Intrinsic Bioremediation of Aromatic Hydrocarbons		
<b>NSERC Strategic Grant - University Industry Partnerships</b>	\$290,000	1997-2000
Title: Tracing Organic Contaminants in Groundwater - A New Environmental Methodology using Compound Specific Isotope Analysis		
Co-investigator: B. Sleep (Civil Engineering, Univ. of Toronto)		
* Grants indicated * below are the industry matching funds for the 1997-2000 Strategic Project		
<b>NSERC Industrially Oriented Research Grant</b>	\$8,000	1998-99
Title: Natural hydrocarbon gas concentrations in near-surface groundwaters		
Industrial Partner: Imperial Oil Ltd.		
<b>RTDF Consortium on Groundwater Contamination</b>	\$18,000	1998-99
Title: Isotopic constraints on chlorinated hydrocarbon contamination at Dover Air Force Base, USA.		
<b>*United Technologies Research Grant</b>	\$13,000	1997-98
Title: Collaborative research on fractionation associated with degradation of toluene in field settings		
<b>*General Electric Research Grant</b>	\$36,000	1997-99
Title: Collaborative research on fractionation associated with degradation of TCE		
Co-investigator: J. Spivack (General Electric Research Division, Schenectady, NY)		
<b>NSERC Operating Grant</b>	\$118,800	1995-99
Title: Inorganic/organic controls on production and flux of carbon gases from deep and shallow groundwaters and wetlands - Isotopic and geochemical characterization.		

<b>*Centre for Groundwater Research - U. of Waterloo</b>	\$50,000	1995-99
<b>Solvents-in-Groundwater Research Funding</b>		
Title: Evaluation of GC-IRMS techniques to identify multi-sources of organic contaminants in groundwater systems		
<b>Imperial Oil University Research Grants</b>	\$28,000	1995-98
Title: Natural hydrocarbon gas concentrations in near-surface groundwaters Implications for assessment of contamination due to gas migration and leakage		
<b>Ontario-Quebec Academic Exchange Program</b>	\$ 3,700	1997-98
Title: Environmental implications of methane gas and brine occurrences in mines on the Canadian Shield. Co-Investigator: J. Guha, Dept. des Sciences de la Terre, Univ. du Quebec à Chicoutimi.		
<b>NSERC Equipment Grant</b>	\$42,334	1994-95
Title: Automated Multiport Manifold for Mass Spectrometer Co-investigators: F.G. Ferris (Geology, Toronto); D. Wedin; R. Jefferies and J. Coleman (Botany, Toronto); J. Gerits (Geography, Toronto); N. Roulet (Geography, McGill); J. Stix (Geologie, Montreal), R. Knowles (Microbiology, McGill).		
<b>Falconbridge Ltd. Research Grant</b>	\$30,000	1994-96
Title: Occurrences of explosive gas and saline groundwater in Kidd Creek Mine, Timmins, Ont.		
<b>American Association of Petroleum Geologists</b>	\$2,000	1995-96
Grants-in-Aid of Field Research Support to S. Taylor Title: Natural hydrocarbon gas concentrations in near-surface groundwaters Implications for assessment of contamination due to gas migration and leakage		
<b>Ontario-Quebec Academic Exchange Program</b>	\$ 2,420	1995-96
Title: Environmental implications of methane gas and brine occurrences in mines on the Canadian Shield. Co-Investigator: J. Guha, Dept. des Sciences de la Terre, Univ. du Quebec à Chicoutimi.		
<b>Research Contract</b>		
<b>Atmospheric Environment Service</b>	\$10,000	1994-95
Title: Geochemical controls on production mechanism and isotopic signature of CH <sub>4</sub> from low boreal wetlands.		
<b>NSERC Operating Grant</b>	\$71,220	1992-95
Title: Geochemical and isotopic controls on the origin and migration of gases in the hydrogeological environment		
<b>Ontario Geoscience Research Grant</b>	\$56,000	1992-94
<b>Ministry of Northern Development and Mines</b>		
Title: The role of N <sub>2</sub> and H <sub>2</sub> in inorganic methanogenesis in the crystalline rocks of the Canadian Shield		
<b>AES/NSERC Science Subvention Program</b>	\$10,000	1993-94
<b>Atmospheric Environment Service - Environment Canada</b>		
Title: CH <sub>4</sub> inputs to the atmosphere from bogs in the Great Lakes Basin Possible geochemical controls on production mechanisms and isotopic signature		
<b>Research Agreements Program</b>	\$6000	1992-93
<b>Energy Mines and Resources</b>		
Title: Migration and mixing of helium within the Southwest Ontario Sedimentary Basin Implications for hydrocarbon gas reservoirs Co-Investigators: S.M. Weise (Institut fuer Hydrologie, Munich, Germany); S.K. Frape (Univ. of Waterloo); J.F. Barker (Univ. of Waterloo)		
<b>Connaught Phase I New Staff Grant</b>	\$10,000	1992-93

<b>Connaught New Staff Matching Grant</b> <b>University of Toronto</b> Title: Environmental applications of GC-IRMS - Production and transport of carbon-bearing compounds in the hydrological environment	\$11,000	1993-95
<b>Operating Grant</b> <b>University of Toronto</b>	\$35,000	1992-93
<b>Equipment Grant - Stable Isotope Laboratory</b> <b>University of Toronto</b>	\$400,000	1992-93
<i>As co-investigator:</i>		
<b>NSERC Networks of Centers for Excellence</b> Title: Carbon Management Canada PI: S. Larter (U. Calgary) Co-PI: B. Mayer (Calgary), J. Grace (UBC), B. Rostron (Alberta), J. Shaw (Alberta), G. Dipple (UBC) D. Lawton (Calgary), J. Meadowcraft (Calgary), B. Sherwood Lollar (Toronto), C. Mims (Toronto)	\$5 million BSL portion \$209,800 over 3 years	2010-2013
<b>National Science Foundation</b> Title: Collaborative Research ETBC – Deep Crustal Biosphere Microbial Cycling of Carbon PI: T.C. Onstott (Princeton) Co-PIs: T. Kieft (NMT); B. Sherwood Lollar (Toronto); G.F. Slater (McMaster); K. Hinrichs (Bremen)	\$700,000 BSL portion: \$57,576 over three years	2010-2012
<b>ESA-NASA Competition ExoMars 2016 Trace Gas Orbiter</b> Title: MATMOS: Mars Atmospheric Trace Molecule Occultation Spectrometer PIs: P. Wennberg (Caltech), V. Hipkin (CSA), J. Drummond (Dalhousie), G. Toon (JPL) Co-PIs: J. Abbatt (Toronto), M. Allen (JPL), P. Bernath (York), J.-F. Blavier (JPL), L. Brown (JPL), R.T. Clancy (SSI), E. Cloutis (Winnipeg), D. DesMarais (NASA Ames), J. Eiler (Caltech), T. Encrenaz (LESIA), A. Kleinboehl (JPL), J. McConnell (York), B. Sherwood Lollar (Toronto), K. Strong (Toronto), W. Walker (Toronto), Y. Yung (Caltech)	BSL portion: approx. \$60,000 pa	2010-2017
<b>CFI Leaders Opportunity Fund</b> <b>Canadian Foundation for Innovation</b> Title: Biozone: A Modern Collaborative Bioengineering Research Facility PI: E. Edwards (Chem. Eng.) Co-PIs: E. Masters and R. Mahadevan (Chem Eng) Co-Investigators: B. Sherwood Lollar, B. Sleep, M. Shoichet and others	\$218,143	
<b>NSERC CREATE Program</b> <b>Canadian Astrobiology Training Program</b> PI: L. Whyte (McGill) Co-investigators: B. Sherwood Lollar (Toronto) N. Banerjee, G. Osinski (UWO) R. Pudritz, G. Slater (McMaster) W. Pollard, H. Vali, J. Nadeau, B. Wing (McGill) E. Cloutis (Winnipeg) Collaborators: NASA Ames, NASA JPL, Canadian Space Agency, MDA Space Missions, MPA Communications	\$1.6 million	2009-2014
<b>Canadian Space Agency Canadian Analogue Research Network</b> <b>CARN 08-01</b> Title: Life in Ice: The detection of microbial activity at Mars analogue sites (cold Saline springs, permafrost/ground ice in the high Arctic) PI: L. Whyte (McGill) Co-investigators: B. Sherwood Lollar (Toronto) T.C. Onstott (Princeton)	\$50,000 BSL portion: \$5000	2010-2011

<b>Genome Canada and Ontario Genomics Institute</b>	\$10 million	2009-2018
<b>BEEM: Bioproducts and Enzymes from Environmental Metagenomics</b>	BSL unfunded collaborator	
PI: E.A. Edwards (Dept of Chemical Engineering Toronto) and D.W. Major (GeoSyntec Inc).		
Co-pi: B. Sherwood Lollar and others		
<b>Canadian Space Agency Canadian Analogue Research Network</b>	\$30,000	2007-2008
<b>CARN 07-01</b>	BSL portion: \$2000	
Title: Life in Ice: The detection of microbial activity via in situ measurements of CH <sub>4</sub> and CO <sub>2</sub> : High Arctic field testing of a Cavity Ring Down Spectrometer (CRDS) for future use on the Martian surface		
PI: L. Whyte (McGill)		
Co-investigators: B. Sherwood Lollar (Toronto)		
T.C. Onstott (Princeton)		
<b>Canadian Space Agency Canadian Analogue Research Network</b>	\$20,000	2007-2008
<b>CARN 07-02</b>	BSL portion: \$2000	
Title: Planetary protection - The survivability of Earth microbes from Canadian High Arctic Mars analogue sites under Martian environmental conditions		
PI: L. Whyte (McGill)		
Co-investigators: B. Sherwood Lollar (Toronto)		
T.C. Onstott (Princeton)		
<b>U.S. Strategic Environmental Research and Development Program</b>	\$1,250,000	2007-2011
Title: Elucidation of the mechanisms and environmental relevance of cis-DCE and VC biodegradation		
PI: E. Cox(GeoSyntec)		
Co-PIs: C. Aziz (GoeSyntec), J. Gossett (Cornell), J. Spain (Georgia Tech)		
E.A. Edwards (Toronto), B. Sherwood Lollar (Toronto)		
<b>NASA ASTID (Astrobiology Science and Technology Development And Mission Concept Studies)</b>	\$1.5 million USD	2008-2011
Title: A CRDS for isotopic measurement of Martian CH <sub>4</sub>		
PI: T.C. Onstott, Dept. of Geosciences, Princeton University		
Co-investigators: K.K. Lehmann (U. of Virginia)		
P. Mahaffy (Mars Science Lab PI - NASA Goddard Space Flight Center)		
H. Riris, I. Kate, J. Burris (all of NASA Goddard Space Flight Center)		
Collaborator: B. Sherwood Lollar (Toronto)		
<b>NASA Astrobiology Institute (NAI) - DDF Fund</b>	\$253,075 USD	2007-2008
Title: Mars Environmental Simulator Studies of Forward Contamination and Biogeochemical Processes		
PI: T.C. Onstott (Princeton)		
L.M. Pratt, D. Bish, A. Schimmelmann (Indiana Univ.)		
S.M. Pfiffner (Tennessee)		
B. Sherwood Lollar (Toronto)		
T.C. Hazen (Lawrence Berkeley National Lab)		
R. Mancinelli, L. Rothschild (SETI)		
J. Bishop (NASA Ames)		
P. Todd (SHOT Inc.)		
P. Kounaves (Tufts)		
K. Zacny (Honeybee Robotics)		
P. Mahaffy (NASA MSL PI)		
A. Schuenger (U of Florida)		
J. Bada (UCSD)		
L. Becker (UCSB)		
C. Omelon, W. Pollard (McGill)		

<p><b>NASA Astrobiology Research Institute (NAI)</b>  Detection of Biosustainable Energy and Nutrient Cycles  in the Deep Subsurface of Earth and Mars  PI: L. Pratt (Chemistry, Indiana U.)  Co-PI's: T.C. Onstott (Princeton), <u>B. Sherwood Lollar</u> (Toronto)  J.K. Fredrickson (PNNL); S. Pfiffner (U. Tennessee);  T. Phelps (ORNL); F. Brockman (PNNL); T. Hazen (LBNL);  S. Clifford (Lunar Planetary Institute)</p>	\$5,000,000 USD	2003-2008
(BSL portion after overhead approximately (\$60,000 Canadian per year))		
<p><b>NSERC Research Tools and Instruments</b>  Title: Microarray Equipment to detect differential gene expression in  biodegrading microbial communities  PI: Edwards (Chem-Eng)  Co-PIs: Sherwood Lollar (Geology), M. Simpson (UTSC)</p>	\$86,204	2006
<p><b>Canadian Space Agency Analogue Site Studies</b>  Title: High Arctic Springs as Mars analogue sites  PI: L. Whyte (McGill)  Co-PIs: W. Pollard (McGill); N. Perreault (McGill);  B. Sherwood Lollar (Toronto); D. Andersen (SETI)</p>	\$20,000	2006
<p><b>NSERC Research Tools &amp; Instruments - Category I</b>  Title: Application of Quantitative Molecular Techniques in Subsurface Bioremediation  PI: E. Edwards (Chemical Engineering and Applied Chemistry)  Co-PIs: B. Sherwood Lollar (Geology); B. Sleep (Civil)</p>	\$72,995	2003
<p><b>NSERC Collaborative Research Development Grant</b>  Title: Biogeochemical Mechanisms for Chlorinated  Ethane Transformation in Groundwater  PI: E. Edwards (Chem. Eng. U of Toronto)  Co-investigators: <u>B. Sherwood Lollar</u> (Geology - U. of Toronto)  B. Sleep (Civ. Eng. U. of Toronto)</p>	\$266,244	2000-2003
<p><b>Canadian Chlorine Coordinating Council</b>  Title: Source Identification of Chloroacetic Acids (CAA)  in the Environment by GC-C-IRMS  PI: S.A. Mabury (Chemistry, University of Toronto)  <u>B. Sherwood Lollar</u> (Geology, University of Toronto)  D.Muir (CCIW, Environment Canada)</p>	\$75,000	1999-2001
<p><b>National Science Foundation</b>  Title: South African Ultradeep Mines - Long Term Sites  for Interdisciplinary Studies (LSLIS) into the Extreme  Environment of the Deep Subsurface  PI: T.C. Onstott, Dept. of Geosciences, Princeton University  Co-investigators: D. Balkwill (FSU); D. Boone (PSU); Brockman (PNNL);  J.K. Fredrickson (PNNL); Kieft (NMIT); Pfiffner (UTenn);  T.Phelps (ORNL); L. Pratt (IU); <u>B. Sherwood Lollar</u> (Toronto);  G. Southam (NAU); M. Stute (Lamont-Doherty);  G. Wallfaardt (Univ. Stellenbosch); D. White (UTenn)</p>	\$1,275,000	1999-2003
<p><b>National Geographic Society</b>  Title: A Window into the Extreme Environment of Deep  Subsurface Microbial Communities: The Witwatersrand  Deep Microbiology Project  PI: T.C. Onstott, Dept. of Geosciences, Princeton University  Co-investigators: J.K. Fredrickson (PNNL); K. Pedersen (Goteborg Univ.);</p>	\$17,707	1998-99

## B. Sherwood Lollar

**U.S. Dept of Energy - Office of Energy Research** \$200,000 1995-1998  
Title: Combined Noble Gas and Stable Isotope Constraints on Nitrogen Gas Source within Sedimentary Basins  
PI: C.J. Ballentine, Dept. of Geological Sciences, Univ. of Michigan  
Co-investigators: B. Sherwood Lollar; A.N. Halliday, Dept. of Geological Sciences, Univ. of Michigan

**Special University Linkage Consolidation Program** \$750,000 1996-2001  
**AUCC-CIDA**  
Title: Geo-environment and its impact on socio-economic development - Guizhou Province, in alliance with the Pearl River Delta, P.R. of China  
PI: J. Guha (Univ. du Quebec a Chicoutimi)

**Faculty of Arts and Sciences - One Time Only Funds** \$10,000 1992-93  
**Field Gas Chromatograph for Environmental Geosciences Teaching Initiative**  
Co:investigator: F.G. Ferris (Univ. of Toronto)

**NSERC Equipment Grant** \$90,301 1991-92  
Title: Phase contrast-fluorescence microscope, spectrophotometer, and anaerobic chamber needed to undertake microbial geochemistry research  
PI: F.G. Ferris (Univ. of Toronto)

## **Currently applied for:**

**NSERC CREATE Grant** LOI 2011-2016  
Title: Reactivity of Organic Matter in the Environment (ROME)  
PI: M. J. Simpson (Univ. of Toronto)  
Co-PIs: A. J. Simpson (Univ. of Toronto), B. Sherwood Lollar (Univ. of Toronto), N. B. Basiliko (Univ. of Toronto), C. Mitchell (Univ. of Toronto), P.P. Frost (Univ. of Toronto), N. Eyles (Univ. of Toronto), S. Lamoureux (Queen's Univ.), J. Whalen (Univ. of McGill), P. Voroney (Univ. of Guelph), P. Sanborn (Northern British Columbia)

**NSERC CREATE Grant** LOI 2011-2016  
Title: Multidisciplinary Applied Geochemistry Network (MAGNET)  
PI: D. Weis (Univ. of British Columbia)  
Co-PIs: S. J. Barnes (Univ. du Quebec), B. Bergquist (Univ. of Toronto), I. Clark (Univ. of Ottawa), R. Francois (Univ. of British Columbia), C. Hillaire-Marcel (UQAM), B. Sherwood Lollar (Univ. of Toronto), J. Stix (Univ. of McGill)

## **C. SCHOLARLY AND PROFESSIONAL WORK**

All co-authors who are students, postdoctoral fellows or research associates directly under my supervision are noted in italics in the publication list below. **My name is underlined on those papers for which I am senior author. This is because different disciplines have different assumptions concerning where the senior author's name should be listed (i.e. second, or last).** Journals are selected for breadth of readership, the quality of the submission and review process and the impact. The majority of my publications are in journals such as *Geochimica Cosmochimica acta*, *Chemical Geology*, and *Environmental Science and Technology*. These three journals have among the highest rated impact factors in environmental geochemistry. We also publish regularly in *Science and Nature*.

### **PEER-REVIEWED REPORTS**

1. National Research Council of the National Academies of Science Report "**An Astrobiology Strategy for the Exploration of Mars**" Committee for Astrobiology Strategy report for Space Studies and Life Sciences boards of the National Academy. National Academy Press (2007) ISBN 978-0-309-10851-5.

2. Hunkeler, D., Meckenstock, R., Sherwood Lollar, B., Schmidt, T. and J.A. Wilson. A consensus guide for assessing biodegradation and source identification of organic contaminants in groundwater using compound specific stable isotope analysis (CSIA). Commissioned by

the IAEA (International Atomic Energy Agency - Vienna) and jointly published by the IAEA and the US EPA (Environmental Protection Agency) as a white paper (best practice guide) to the application of compound specific isotope analysis to contaminant hydrogeology. Publication date: Dec. 2008. EPA Guidance Document EPA 600/R-08/148

3. Council of Canadian Academies Report "**The Sustainable Management of Groundwater Resources in Canada**" Expert Panel on Groundwater Report (April 2009). J.P. Bruce, W. Cunningham, A. Freeze, R. Gillham, S. Gordon, S. Holysh, S. Hrudey, W. Logan, K. MacQuarrie, P. Muldoon, L. Nowlan, J. Pomeroy, S. Renzetti, B. Sherwood Lollar, and R. Therrien.

4. Mars Astrobiology Explorer Cacher (MAX-C): A Potential Rover Mission for 2018. Final Report of the Mars Mid-Range Rover Science Analysis Group (MRR-SAG). Pratt, L.M., C. Allen, A.C. Allwood, A. Anbar, S.K. Atreya, D.W. Beaty, M.H. Carr, J.A. Crisp, D.J. Des Marais, J.A. Grant, D.P. Glavin, V.E. Hamilton, K. Herkenhoff, V. Hipkin, B. Sherwood Lollar, T.M. McCollom, A.S. McEwen, S.M. McLennan, R.E. Milliken, D.W. Ming, G.G. Ori, J. Parnell, F. Poulet, C.G. Salvo, F. Westall, C.W. Whetsel, and M.G. Wilson (2009) 94 pp., posted October 29, 2009, by the Mars Exploration Program Analysis Group (MEPAG) at <http://mepag.jpl.nasa.gov/reports/>.

5. B. Sherwood Lollar. **Far-Field Microbiology Considerations Relevant to a Deep Geologic Repository - State of Science Review**. NWMO-TR-2010-23. Nuclear Waste Management Organization. Dec. 2010. 65 p.

## NON-PEER-REVIEWED REPORTS

1. Report of the Joint NASA Astrobiology Institute/ Mars Exploration Planning Advisory Group Science Laboratory Caching Working Group (NAI/MEPAG).A, Steele, L. Beegle, D. DesMarais, B. Sherwood Lollar, C. Neal, P. Conrad, D. Glavin, T. McCollom, K. Karcz, C. Allen, E. Vincenzi, S. Cady, J. Eigenbrode, D., Papineau, V. Starke, M. Glamoclija, M. Fogel, L. Kerr, J. Maule, G. Cody, I. TenKate, K. Buxbaum, I. Borg, S. Symes, D. Beaty, C. Pilcher, M. Meyer, C. Conley, J. Rummel, R. Zurek and J. Crisp. (2007). Posted Jan. 2008 at <http://mepag.jpl.nasa.gov/reports/index.html>.

2. White Paper on Groundwater Control Systems for Italian MOE (in Italian) B. Sherwood Lollar, T.D. Stark, A. Valocchi (2008)

## 7. PUBLICATIONS REFEREED AND IN REVIEW

### EDITED BOOKS

Environmental Geochemistry Vol. 9 (Vol. editor B. Sherwood Lollar) Treatise on Geochemistry (eds. H.D. Holland and K.K. Turekian), Elsevier, Oxford (2003). Based on demand this volume will be one of the two first volumes republished in a paperback edition in 2005. Preparation for a revised second edition is also underway. The *Treatise on Geochemistry* presents a comprehensive, integrated summary of the present state of the field for a full range of disciplines and topics in geochemistry. All chapters are peer reviewed and contributed by the leading experts in the field of research. K. Turekian (Yale University) and H.D. Holland (Harvard University) are the executive editors of the series. Volume editors are Andrew Davis, Rick Carlson, Roberta Rudnick, Ralph Keeling, Tim Drever, Harry Elderfield, Fred MacKenzie, Bill Schlesinger and Barbara Sherwood Lollar. **Paperback edition of Volume 9 published in May 2005 has already sold over 1250 copies.** This work won the Geoscience Information Society (GSIS) Mary B. Ansari Best Reference Work Award at the **Geological Society of America Annual Meeting (2004)**.

### SCOPUS Citation History as of Sept. 3, 2011.

As per Advanced Search under AUTHOR-NAME (Lollar, B.S.) or AUTHOR-NAME (Sherwood Lollar, B.)

Total Citations: 2467 h index = 29.

111. *Mundle, S.O.C., Johnson, T., Lacrampe-Couloume, G., Perez-de-Mora, A., Duhamel, M., Edwards, E.A., McMaster, M.L., Cox, E., Revesz, K. and Sherwood Lollar, B.* Monitoring biodegradation of ethane and bioremediation of chlorinated ethenes at a contaminated site. (submitted to **ES&T**).

110. Silver, B.J., Raymond, R., Sigman, D., Prokopenko, M., Sherwood Lollar, B., Lacrampe-Couloume, G., Fogel, M., Pratt, L.M., Lefcariu and Onstott, T.C. The origin of NO<sub>3</sub><sup>-</sup> and N<sub>2</sub> in the continental subsurface of South Africa. (submitted to **Chemical Geology**)

109. *Vandersteen, A., Mundle, S., Lacrampe-Couloume, G., Sherwood Lollar, B., Kluger, R.* (2011) Carbon kinetic isotope effects as evidence for hydrolytic decarboxylation of indole-3-carboxylic acid. (submitted to **Journal of American Chemical Society**).

108. Long, L., Sherwood Lollar, B., Li, H., Wortmann, U. G., *Lacrampe-Couloume, G.*, (2011) Ammonium stability and nitrogen isotope fractionation between  $\text{NH}_4^+$  and  $\text{NH}_3$  at 20-70° and pH of 2-13: Applications to habitability and nitrogen cycling in low-temperature hydrothermal systems. In revision **Geochimica et Cosmochimica acta**.
107. Liang, X., Howlett, M. R., Nelson, J., Grant, G., Dworatzek, S., *Lacrampe-Couloume, G.*, Zinder, S., Edwards, E. A., Sherwood Lollar, B. (2011) Pathway-dependent isotope fractionation during aerobic and anaerobic degradation of monochlorobenzene and 1,2,4- trichlorobenzene. in press **Environmental Science and Technology**.
106. Telling, J., Sherwood Lollar, B., *Lacrampe-Couloume, G.* (2011) The intermolecular  $\delta^2\text{H}$  pattern of abiogenic methane and  $\text{C}_2^+$  alkanes produced during ion polymerization: relevance to extraterrestrial and terrestrial settings. (submitted to **Origins of Life and the Evolution of the Biosphere**).
105. Tumarkin, E., Nie, Z., Park, J.I., Abdelhasani, M., Greener, J., Sherwood Lollar, B., Guenther, A. and Kumacheva, E. (2011) Temperature-controlled “breathing” of carbon dioxide bubbles. In press **Royal Society of Chemistry – Lab on a Chip**.
104. Davidson, M.M., Silverm B.J., Onstott, T.C., Moser, D.P., Gihring, T.M., Pratt, L.M., Boice, E.A., Sherwood Lollar, B., Lippmann-Pipke, J., Pfiffner, S., Kieft, T.M., Seymoor, W., and Ralston, C. (2011) Capture of planktonic microbial diversity in fractures by long-term monitoring of flowing boreholes, Evander Basin, South Africa. **Geomicrobiology Journal** 28(4):275-300.
103. Lippmann-Pipke, J., Sherwood Lollar, B., Neidermann, S., Stroncik, N., Naumann, R., van Heerden, E. and Onstott, T.C. (2011) Neon identifies two billion year old fluid component in the Witwatersrand Basin. **Chem GLG** Vol. 283:287-296.
102. Sherwood Lollar, B., *Hirschorn, S.*, Mundle, S.O.C., Grostern, A., Edwards, E.A., *Lacrampe-Couloume, G.* (2010) Insights into enzyme kinetics of chloroethane biodegradation using compound specific isotope analysis **ES&T** 44:7498-7503.
101. Mundle, S.O.C., Rathgeber, S., *Lacrampe-Couloume, G.*, Sherwood Lollar, B., Kluger, R. (2010) Hydrolytic decarboxylation of carboxylic acids and the formation of protonated carbonic acid. *Journal of American Chemical Society* Vol. 132(7):2430-2436.
100. *McKelvie, J.R.*, *Elsner, M.*, Simpson, A.J., Sherwood Lollar, B., Simpson, M.J. (2010) Quantitative site-specific  $^2\text{H}$  NMR investigation of MTBE: Potential for investigating contaminant sources and fate. *E S & T* Vol. 44:1062-1068.
99. Niederberger, T.D., Perrault, N.N., *Tille, S.*, Sherwood Lollar, B., *Lacrampe-Couloume, G.*, Andersen, D., Greer, C.W., Pollard, W. and Whyte, L.G. (2010) Microbial characterization of a subzero, hypersaline methane seep in the Canadian High Arctic. **ISME** 4:1326-1339.
98. McCollom, T.M., Sherwood Lollar, B., *Lacrampe-Couloume, G.* and Seewald, J.S. (2010) The influence of carbon source on abiotic organic synthesis and carbon isotope fractionation under hydrothermal conditions. **Geochimica et Cosmochimica Acta** 74:2717-2740.
97. *Elsner, M.*, *Lacrampe-Couloume, G.*, Mancini, S., Burns, L. Sherwood Lollar, B. (2010) Carbon isotope analysis to evaluate nanoscale Fe(0) treatment at a chlorohydrocarbon contaminated site. **GWMR** 30:79-95.
96. Silver, B. J., Onstott, T.C., Rose, G., Lin, L.-H., Ralston, C., Sherwood Lollar, B., Pfiffner, S.M., Kieft, T.L., McCuddy, S. (2010) *In situ* cultivation of subsurface microorganisms in a deep mafic sill: Implications for SLiMEs. **Geomicrobiology Journal** 27:329-348.
95. Onstott, T.C., Frappe, S.K., Stotler, R., Johnson, E.J., Vishnivetskaya, T.A., Rothmel, R. Pratt, L.M. and Sherwood Lollar, B., (2009) Microbial communities in subpermafrost saline fracture water at Lupin Au Mine Nunavut, Canada. **Microbial Ecology** 4:786-807.
94. Mundle, S.O.C., Rathgeber, S., *Lacrampe-Couloume, G.*, Sherwood Lollar, B., Kluger, R. (2009) Internal return of carbon dioxide in decarboxylation reactions: Catalysis of separation and  $^{12}\text{C}/^{13}\text{C}$  kinetic isotope effects. *Journal of American Chemical Society* Vol. 131:11638-11639. Highlighted on JACS website.
93. *Morrill, P.L.*, Seepersad, D.J., McMaster, M.L., Hood, E.D., LeBron, C., Major, D.W., Edwards, E.A., Sleep, B.E. and Sherwood

- Lollar, B. (2009) Variations in expression of carbon isotope fractionation of chlorinated ethenes during biologically enhanced dissolution of PCE close to a source zone. *Journal of Contaminant Hydrology* 110:60-71.
92. Sherwood Lollar, B. and Ballentine, C.J. (2009) Insights into deep carbon from noble gases. **Nature Geoscience**. Vol. 2: 543-547.
91. Gilfillan, S.M.V., Sherwood Lollar, B., Holland, G., Blagburn, D., Stevens, S., Schoell, M., Cassidy, M., Ding, Z., *Lacrampe-Couloume, G.*, Zhou, Z. and Ballentine, C.J. (2009) Solubility trapping in formation water as dominant CO<sub>2</sub> sink in natural gas fields. **Nature** 458:614-618. Cover story April 2, 2009 issue.
90. Jennings, L.K., *Chartrand, M.M.G.*, *Lacrampe-Couloume, G.*, Sherwood Lollar, B., Spain, J.C. and Gossett, J.M. (2009) Proteomic and transcriptomic analyses reveal genes upregulated by cis-dichloroethene in *Polaromonas JS666* **Applied and Environmental Microbiology** 75:3733-3744.
89. *McKelvie, J.R.*, Hyman, M.R., *Elsner, M.*, Smith, C., Aslett, D.M., *Lacrampe-Couloume, G.* and Sherwood Lollar, B. (2009) Isotopic fractionation of MTBE suggests different initial reaction mechanisms during aerobic biodegradation. **Environ. Sci & Technol** 43:2793-2799.
88. Sherwood Lollar, B., *Lacrampe-Couloume, G.*, *Voglesonger, K.*, Onstott, T.C., Pratt, L.M. and Slater, G.F. (2008) Isotopic signatures of CH<sub>4</sub> and higher hydrocarbon gases from Precambrian Shield sites: A model for abiogenic polymerization of hydrocarbons. **Geochimica et Cosmochimica Acta** 72:4778-4795.
87. Perreault, N.N., Greer, C.W., Anderson, D.T., *Tille, S.*, *Lacrampe-Couloume, G.*, Sherwood Lollar, B. and Whyte, L.G. (2008) Heterotrophic and autotrophic microbial populations in cold perennial springs of the High Arctic. **Applied and Environmental Microbiology** Vol. 74: 6898-6907.
86. *Mancini, S.A.*, Devine, C.E., *Elsner, M.*, Nandi, M.E., Ulrich, A.C., Edwards, E.A. and Sherwood Lollar, B. (2008) Isotopic evidence suggests different initial reaction mechanisms for anaerobic benzene biodegradation. **Environ. Sci & Technol**. 42:8290-8296.
84. *Elsner, M.*, *VanStone, N.*, *Lacrampe-Couloume, G.*, Sherwood Lollar, B. (2008) Identifying abiotic chlorinated ethene degradation: Characteristic isotope patterns in reaction products with nanoscale zero-valent iron. **Environ. Sci & Technol** Vol. 42:5963-5970.
83. Beller, H.R., Kane, S.R., Legler, T.C., *McKelvie, J.R.*, Sherwood Lollar, B., Pearson, F., Balser, L. and Mackay, D.M. (2008) Comparative assessments of BTX natural attenuation by quantitative PCR of a catabolic gene, signature metabolites, and compound-specific isotope analysis. **Environ. Sci & Technol**. Vol. 42:6065-6072.
82. *VanStone, N.*, *Elsner, M.*, *Lacrampe-Couloume, G.*, Mabury, S., Sherwood Lollar, B. (2008) Potential for identifying abiotic chloroalkane degradation mechanisms using carbon isotope fractionation. **Environ. Sci & Technol**. Vol. 42:126-132.
81. Pfiffner, S.M., Onstott, T.C., Ruskeeniemi, T., Talikka, M., Bakermans, C., McGown, D., Chan, E., Johnson, A., Phelps, T.J., Le Puil, M., DiFurio, S.A., Pratt, L.M., Stotler, R., Frape, S., *Telling, J.*, Sherwood Lollar, B., Neill, I., and Zerbin, B. (2008) Challenges for coring deep permafrost on Earth and Mars. **Astrobiology** Vol. 8:623-638.
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**10. PAPERS PRESENTED AT MEETINGS AND SYMPOSIA** (Invited talks listed separately below)

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Sherwood Lollar, B., Ballentine, C., and O'Nions, R.K. (1998) Non-hydrocarbon gases in sedimentary systems - Evidence for mantle-derived CO<sub>2</sub> in the Pannonian Basin based on stable isotope signatures and C/He ratios. American Chemical Society Spring Meeting. Dallas, Tx. (March 1998).

Ballentine, C., Sherwood Lollar, B. and Halliday, A. (1998) Non-hydrocarbon gases in sedimentary systems - Nitrogen gas sources in sedimentary basins of the western U.S. American Chemical Society Spring Meeting. Dallas, Tx. (March 1998).

Taylor, S., Sherwood Lollar, B., Wassenaar, L. and J.M. Hendry. Bacterial hydrocarbon production in shallow bedrock aquifers and surficial till aquitards, Saskatchewan, Canada. Geological Society of America Annual Meeting. Salt Lake City (Oct. 1997).

Slater, G.F., Dempster, H., Sherwood Lollar, B., Spivack, J., Brennan, M. and P. Mackenzie. Isotopic investigation of TCE degradation using GC/C/IRMS coupled with headspace analysis. Geological Society of America Annual Meeting. Salt Lake City (Oct. 1997).

Ferris, F.G., Gerits, J.P., Sherwood Lollar, B., Schultze-Lam, S. Carbonate and silicate mineral deposition in a saline-alkaline lake microbial mat. XIII International Symposium on Environmental Biogeochemistry, Monopoli (Bari) Italy. (Sept. 1997).

Slater, G. F., Dempster, H. and Sherwood Lollar, B. Technical developments in applications of GC/C/IRMS to \*<sup>13</sup>C analysis of low level dissolved chlorinated compounds. University of Waterloo Continuous Flow Isotopic Analysis (CFIRMS) Workshop, Waterloo (Aug. 1997).

## 11. INVITED LECTURES

### Invited Lectures for 1998 Henry Darcy Distinguished Lecture Series

*Stable Carbon Isotopes: Tools for detection of the origin  
and fate of environmental contaminants*

University of Texas at Austin	Thurs. Jan 22
Texas A&M	Fri. Jan. 23
University of Virginia	Thurs Feb. 5
University of California Santa Cruz	Weds. Feb 18
University of California Davis	Thurs Feb 19
United States Geological Survey Menlo Park	Fri. Feb 20
Colorado School of Mines	Mon. Feb 23
University of Florida	Weds. Mar 4
Florida State University	Thurs Mar 5
Princeton University	Mon. Mar 9
University of Toronto	Thurs March 12
University of Tennessee	Thurs. Mar 19
Queens University, Canada	Tues. Mar 24
University of Michigan	Tues Apr. 7
Laval University	Mon May 18
Johns Hopkins University	Fri Oct 2
United States Geological Survey Reston	Mon. Oct. 5
Portland State University	Thurs. Oct. 15
Washington State University	Fri Oct. 16
Michigan State University	Thurs Nov 12
University of Waterloo	Thurs Nov. 19
University of Western Ontario	Weds Nov. 25
NGWA National Meeting, Las Vegas	Tues. Dec 14

### *International Darcy Lectures*

University of Brest, France	Thurs April 23
University of Rennes, France	Friday April 24
Queens University - Belfast	Mon. April 27
University College London	Tues April 28
Hebrew University of Jerusalem	Sun June 14

### *Additional Invited Lectures*

- Sherwood Lollar, B. Tracers in the Deep. Isotopic insights into subsurface energy for life and microbial metabolism. **Invited** University of Washington NAI Seminar on Astrobiology. Seattle, WA. Nov. 2011.
- Sherwood Lollar, B., van Heerden, E., Onstott, T.C., Kieft, T.M., Itavaara, M. (2011) Follow the water – an search strategy for exploration of the Earth’s deep biosphere. **Keynote**. Pardee Symposium, Geological Society of America Annual Meeting. Minneapolis, MN. Oct. 2011.
- Sherwood Lollar, B., van Heerden, E., Onstott, T.C., Kieft, T.M. (2011) Underground research laboratories and deep mines as a window into subsurface microbiology. **Keynote**. 12<sup>th</sup> International Conference on Topics in Astroparticle and Underground Physics. Munich, Germany. Sept. 2011
- Sherwood Lollar, B. Tracers in the Deep. Isotopic insights into subsurface energy for life and microbial metabolism. **Keynote**. International Symposium on Subsurface Microbiology. Garmisch-Partenkirchen, Germany. Sept. 2011.
- Sherwood Lollar, B. Emerging trends in contaminants research from CSIA. **Invited**. CSI-Environment Meeting. Prague CZ. Aug. 2011
- Sherwood Lollar, B. Biosignatures and Clues to Life: Implications for Origins of Life and Bioastronomy. **Invited** Introductory Talk. Origins 2011 Joint Meeting of the ISSOL (International Astrobiology and Origins of Life Society) and Bioastronomy Society. Montpellier, FR. July 2011.
- Sherwood Lollar, B. **Invited Panel Presentation** CSIA: Monitoring and Assessing Biogeochemical Processes. Battelle International Symposium on Bioremediation and Sustainable Environmental Technologies, Reno, NV. June 2011.
- Mundle, S.O.C., Johnson, T., Lacrampe-Couloume, G., Duhamel, M., Perez-de-Mora, A., Edwards, E.A., Kluger, R., Sherwood Lollar, B., Tiedeman, C. R., Revesz, K., Imbrigiotta, T. E., Cox, E.* Using <sup>13</sup>C isotope signatures of ethene as a direct indicator to assess the accumulation of toxic daughter products of trichloroethene. **Invited**. Battelle International Symposium on Bioremediation and Sustainable Environmental Technologies, Reno, NV. June 2011.
- Chan, C.H., Tang, S., Eckert, T., Lacrampe-Couloume, G., Edwards, E.A., Sherwood Lollar, B.* Compound specific isotope analysis on biotic degradation of chloroform and implication for monitoring anthropogenic-sourced trichlorinated carbon compounds. **Invited**. Battelle International Symposium on Bioremediation and Sustainable Environmental Technologies, Reno, NV. June 2011.
- Elsner, M., Lacrampe-Couloume, G., Mancini, S., Burns, L. and Sherwood Lollar, B.* The use of compound specific isotope analysis (CSIA) to distinguish between biotic and abiotic degradation of chlorinated hydrocarbons in the field. **Invited**. Battelle International Symposium on Bioremediation and Sustainable Environmental Technologies, Reno, NV. June 2011.
- Sherwood Lollar, B. Far Field Microbiological considerations relevant to a deep geological repository: Nuclear Waste Management Organization **Invited** Geoscience Seminar. Hockley Valley, ON. June 2011.
- Sherwood Lollar, B. Insights into deep carbon and subsurface microbial life derived from noble gases. **Invited Departmental Seminar**. Institute de Physique du Globe (IPGP), Universite de Paris, Paris France. April 2011.
- Sherwood Lollar, Ballentine, C.J., and Shock, E. Deep Horizons: Research themes within the Deep Carbon Observatory and links to astrobiology. **Invited**. Webinar for Canadian Astrobiology Training Program (NSERC Create). March 2011.
- Sherwood Lollar, Ballentine, C.J., and Shock, E. Deep Horizons - Implications of the deep carbon cycle for life, energy and the environment. **Invited**. American Geophysical Union Annual Fall Meeting, San Francisco, CA. Dec 2010.
- Sherwood Lollar, B. and Ballentine, C.J. Moving beyond tracers: <sup>13</sup>C insights into carbon sequestration. **Keynote**. Geological Society of America Annual Meeting Denver, CO Oct. 2010.
- Sherwood Lollar, B. Noble gas-derived insights into carbon cycling into the deep biosphere. **Invited**. Washington University at St. Louis, Departmental Seminar St. Louis, Oct. 2010.

- Sherwood Lollar, B. Beyond the Deep Hot Biosphere: Subsurface Microbiology of the Deep Continents. **Invited.** Gordon Research Conference in Organic Geochemistry. Holderness NH. Aug. 2010
- Sherwood Lollar, B. and Ballentine, C.J. Moving beyond tracers:  $^{13}\text{C}$  insights into carbon sequestration. Keynote-1 20<sup>th</sup> Annual V. M. Goldschmidt Conference, Knoxville TN June 2010.
- Ballentine, C.J. and Sherwood Lollar, B. Noble gas isotope insights into the geological storage of carbon. Keynote-2 20<sup>th</sup> Annual V. M. Goldschmidt Conference, Knoxville TN June 2010.
- Sherwood Lollar, B., McKelvie, J., Elsner, M., Mancini, S., Johnson, T., Simpson, M., Simpson, A., Edwards, E., Gossett, J., Jennings, L., Spain, J. and Cox, E. **Invited.** New developments in forensic evaluation of contaminant sources and microbial degradation pathways using CSIA. Seventh International Battelle Conference on Remediation of Chlorinated and Recalcitrant Compounds. Monterey, CA. May 2010.
- Sherwood Lollar, B. Noble gas-derived insights into carbon cycling into the deep biosphere. Invited. Penn State Departmental Colloquium. April 2010. State College, PA.
- Sherwood Lollar, B., Morrill, P.L., Cody, G.D., Fogel, M.L., Lacrampe-Couloume, G., McCollom, T.M., Seewald, J.S., Weinberger, D. Invited. Bridging the gap between experimental and field investigations of abiotic hydrocarbon synthesis. ABSCICON 2010. Astrobiology Science Conference. League City Tx. April 2010.
- McCollom, T.M., Sherwood Lollar, B., Lacrampe-Couloume, G., and Seewald, J.S. Invited. The role of carbon source in abiotic hydrocarbon synthesis and isotope fractionation under hydrothermal conditions. ABSCICON 2010. Astrobiology Science Conference. League City Tx. April 2010.
- Sherwood Lollar, B. Invited Presentation to Canadian Institute for Advanced Research (CIFAR) Board. Astrobiology: The Search for Signs of Life in Outer and Inner Space. Petroleum Club. Calgary AB. Oct 2009.
- Sherwood Lollar, B. Invited Presentation to Canadian Institute for Advanced Research (CIFAR) Board. Astrobiology - the Study of Life in the Universe. Toronto ON. June 2009.
- Ballentine, C.J., Gilfillan, S.M.V., Sherwood Lollar, B., Holland, G., Blagburn, D., Stevens, S., Schoell, M., Cassidy, M., Ding, Z., Zhou and *Lacrampe-Couloume G.* **Invited.** Carbon dioxide gas fields: A science gold mine. ICGG 10 Meeting. Sept. 2009.
- Sherwood Lollar, B., Tille, S., Moran, J., Voglesonger, K., Lacrampe-Couloume, G., Onstott, T.C. and Slater, G.F. (2009) The deep cool terrestrial biosphere: Fracture waters and dissolved gases at > 2.5 km in the Canadian Shield. **Invited.** 19<sup>th</sup> Annual V. M. Goldschmidt Conference, Davos, Switzerland. June 2009.
- Gilfillan, S.M.V., Sherwood Lollar, B., Holland, G., Blagburn, D., Stevens, S., Schoell, M., Cassidy, M., Ding, Z. *Lacrampe-Couloume, G., Zhou, Z. and Ballentine, C.J.*  $\text{CO}_2$  dissolution in formation water dominant sink in natural gas fields. **Invited.** 19<sup>th</sup> Annual V. M. Goldschmidt Conference, Davos, Switzerland. June 2009.
- Sherwood Lollar, B., Tille, S., Moran, J., Voglesonger, K., Lacrampe-Couloume, G., Onstott, T.C., Pratt, L.M. and Slater, G.F. (2009) . **Invited.** Hydrogeologic Controls on the Deep Terrestrial Biosphere - Chemolithotrophic Energy for Subsurface Life on Earth and Mars. American Geophysical Union Spring Meeting. May 2009. Toronto, ON Canada.
- Sherwood Lollar, B., Edwards, E., Hirschorn, S., Mancini, S., and Devine, C. Compound Specific Stable Isotope Fractionation to Distinguish Metabolic Pathways in Microbial Systems. Invited Lecture. REMTEC. Atlanta GA April 2009.
- Sherwood Lollar, B. Earth subsurface analogues and relevance for Martian methane. Invited Lecture to CIFAR Astrobiology Workshop. Toronto ON. April 2009.
- Sherwood Lollar, B. Tracers in the deep: Isotopic and geochemical evidence for  $\text{H}_2$  autotrophy and methanogenesis in the deep subsurface. Invited Lecture. Arizona State University. Tempe AZ March 2009.
- Edwards, E. and Sherwood Lollar, B. Compound Specific Isotope Analysis as a natural reaction probe for delineation of microbial

- degradation pathways. **Invited.** REMTEC Meeting. Atlanta GA. March 2009.
- Sherwood Lollar, B. Tracing contaminant source and fate in groundwater using compound specific isotope analysis. University of Florida Hubbell Distinguished Lecture. Feb. 2009. Gainesville, FL.
- Sherwood Lollar, B. Stable isotopes to determine the origin of hydrocarbon gases. Invited Lecture to NWMO (Nuclear Waste Management Organization) Toronto ON. Jan. 2009
- Sherwood Lollar, B., McCollom, T., Seewald, J.S. and *Lacrampe-Couloume, G.* Abiotic Organic Hydrocarbon Chemistry of the Terrestrial Deep Subsurface: Isotopic Constraints on Reaction Mechanisms. **Invited.** American Geophysical Union Annual Meeting. San Francisco, CA. Dec. 2008.
- McKelvie, J., Mackay, D., Scow, K., Kaiser, P. and Sherwood Lollar, B.* 2008. Quantification of *in situ* biodegradation rates of groundwater contaminants using laboratory-derived isotopic enrichment factors. **Invited.** Geological Society of America Annual Meeting. Houston TX. Oct. 2008.
- Ballentine, C.J., Gilfillan, S., Holland, G., Zhou, Z., Sherwood Lollar, B. And Cassidy, M. 2008. The geological storage of CO<sub>2</sub>: Quantification of natural gas/groundwater interaction. **Keynote.** 18<sup>th</sup> Annual V. M. Goldschmidt Conference, Vancouver BC July 2008.
- Sherwood Lollar, B. Deep abiotic synthesis of organic molecules, and the abiotic-biotic controversy. **Keynote.** Deep Carbon Cycle Sloan Foundation Workshop. Carnegie Institute of Washington. May 2008.
- Sherwood Lollar, B. Using stable carbon and hydrogen isotope analysis to characterize microbial degradation of organic contaminants in groundwater. Electron Transfer Processes at Biogeochemical Gradients Workshop. **Invited Keynote.** UFZ Leipzig, Germany. March 2008.
- Sherwood Lollar, B. Compound Specific Isotope Geochemistry for Assessment and Quantification of Remedial Performance. **Invited.** Partners in Environmental Technology Technical Symposium and Workshop. SERDP-ESTCP. Washington DC. Dec. 2007.
- Sherwood Lollar, B. *Mancini, S., Morrill, P., Elsner, M.E., VanStone, N., Chartrand, M.M.G., Hirschorn, S., McKelvie, J., Lacrampe-Couloume, G., Edwards, E.* The role of vital effects on stable carbon isotope fractionation during transformation of hydrocarbon contaminants in groundwater: Implications for identification of reaction pathways and quantification. **Keynote** International Workshop on Stable Isotope Tools for the Assessment of Chemical and Microbial Transformation Reactions in Complex Natural and Contaminated Environments. Swiss Federal Institute of Technology (ETH) Zurich Mt. Verita CH Nov. 2007.
- Sherwood Lollar, B., Chartrand, M.C., Hirschorn, S., Howlett, M., Bidleman, T., Jantunen, L., Mancini, S., McKelvie, J., Lacrampe-Couloume, G and Edwards, E.A. Compound Specific Stable Isotope Analysis: Research Frontiers in Isotope Hydrology and Water Resources Management. **Invited Keynote.** International Symposium on Advances in Isotope Hydrology and its Role in Sustainable Water Resources Management. Vienna Austria. May 2007.
- Sherwood Lollar, B. Tracers in the Deep: Hydrogeologic controls on release of H<sub>2</sub> energy for deep subsurface life. **Invited.** Stanford University Oceans Seminar Series. Palo Alto, CA. April 2007.
- Elsner, M., Cwiertny, D.M., Chartrand, M.M.G., Lacrampe-Couloume, G., Roberts, A.L. and Sherwood Lollar, B. Probing oxide surface reactivity with organic contaminants: From kinetic and product studies to stable isotope fractionation. **Invited.** American Chemical Society Annual Spring Meeting. Chicago, IL. March 2007. Awarded **American Chemical Society Division of Environmental Chemistry Certificate of Merit**
- Sherwood Lollar, B. Life's Chemical Kitchen: Support of deep terrestrial subsurface life by abiogenic hydrogen and hydrocarbons. **Invited.** United States Geological Survey Western Region Colloquium Seminar Series. Menlo Park, CA. March 2007.
- Sherwood Lollar, B. Hydrogen-rich fluids in the deep earth: Potential for chemoautotrophy. **Royal Society of Canada - Science Council of Japan WISET Invited Lecture.** Tokyo Institute of Technology, Tokyo, Japan. Jan. 2007.
- Sherwood Lollar, B. Stable Isotope Geochemistry and Groundwater Remediation. **Royal Society of Canada - Science Council of Japan**

**WISET Invited Lecture.** Ochanomizu University, Tokyo, Japan. Jan. 2007.

Sherwood Lollar, B. Hydrogen-rich fluids in the deep earth: Potential for chemoautotrophy. **Royal Society of Canada - Science Council of Japan WISET Invited Lecture.** Japan Agency for Marine-Earth Science & Technology (JAMSTEC) Yokohama, Japan. Jan. 2007.

Sherwood Lollar, B. Challenges for Women in Science and Engineering in Canada. **Royal Society of Canada - Science Council of Japan WISET Invited Lecture.** National Womens' Education Centre (NWECC) Japan. Jan. 2007.

Sherwood Lollar, B., Lacrampe-Couloume, G., Slater, G.F., Telling, J. and Voglesonger, K. H<sub>2</sub>-rich fluids in the deep Earth: Potential for chemoautotrophic microbial ecosystems. Origins Institute **Invited Seminar.** McMaster University, Hamilton, ON. October 2006.

Sherwood Lollar, B. Lacrampe-Couloume, G., Telling, J., Slater, G.F. and McCollom, T.M. Compound specific isotope analysis and the challenge for identifying life: the role of biosignatures and abiosignatures. **Invited.** 16<sup>th</sup> Annual V. M. Goldschmidt Conference, Melbourne Australia. Aug. 2006.

Onstott, T.C., Pratt, L.M., Clifford, S.M., Sherwood Lollar, B. and Phelps, T.J. Martian subsurface biomes: How important is radiolysis? **Invited.** 16<sup>th</sup> Annual V. M. Goldschmidt Conference, Melbourne Australia. Aug. 2006.

Sherwood Lollar, B. H<sub>2</sub>-rich fluids in the deep earth - Role of abiogenic water-rock interactions and potential for chemolithoautotrophy. **Invited.** Gordon Research Conference on Organic Geochemistry Holderness School, NH. Aug. 2006.

Sherwood Lollar, B. Isotopic constraints on habitability and activity of the deep biosphere - tales from 2-3.5 km in the deep Precambrian Shield groundwaters. **Invited.** University of Southern California International Geobiology Symposium on the Deep Biosphere. June 2006. Santa Catalina CA.

Sherwood Lollar, B. Telling, J., Lacrampe-Couloume, G., Slater, G.F., Onstott, T.C. and Pratt, L.M. Distinguishing abiogenic versus biogenic sources of methane and implications for Mars exploration. **Invited Keynote.** American Geophysical Union Spring Meeting. Baltimore MD May 2006.

Sherwood Lollar, B. Using stable carbon isotope analysis to identify source and degradation of chlorinated solvents in groundwater. **Invited talk.** Buckley Lecture in Environmental Geology. University of Illinois. Urbana, IL. April 2006

Sherwood Lollar, B. Tracing contaminant source and fate in groundwater using stable carbon isotope analysis. **Invited talk.** Division of Earth and Ocean Sciences. Duke University. Durham NC. April 2006

Sherwood Lollar, B. Tracers in the Deep: Isotopic and geochemical evidence for H<sub>2</sub> autotrophy and methanogenesis in the deep subsurface. **Invited talk.** University of Toronto at Mississauga. Feb. 2006

Sherwood Lollar, B. Tracers in the Deep: Isotopic and geochemical evidence for H<sub>2</sub> autotrophy and methanogenesis in the deep subsurface. **Invited talk.** Centre for Applied Geosciences. University of Tuebingen. Tuebingen, Germany. Jan. 2006

Sherwood Lollar, B. Contaminant source and fate in groundwater using stable carbon isotopes. **Invited talk.** Centre for Applied Geosciences. University of Tuebingen. Tuebingen, Germany. Jan. 2006

Sherwood Lollar, B. Threats to Canadian Groundwater: Microbial Clean-up and the Challenge of Invisible Technology. **Special Invited Lecture on Technology.** Queen's University. Kingston, Ontario. Nov. 2005.

Sherwood Lollar, B. Carbon and hydrogen isotope measurements in abiogenic hydrocarbon synthesis. **Invited talk.** Carnegie Institute of Washington, Washington DC. June 2005.

Sherwood Lollar, B., Telling, J., Lacrampe-Couloume, G., Slater, G.F., Onstott, T.C. and Pratt, L.M. Resolving abiogenic versus biogenic sources of methane and implications for Mars exploration. **Invited Talk.** Methane on Mars NASA Astrobiology Institute Distributed Workshop. NASA Goddard Space Flight Centre, Greenbelt MD. May 18, 2005.

Sherwood Lollar, B. Use of stable isotopes to evaluate contaminant degradation. **Invited.** 2005 CNYAPG Symposium on Isotopic

Geochemistry. Skeneatales NY. April 2005.

- McKelvie, J.*, Sherwood Lollar, B., *Lacrampe-Couloume, G.*, (University of Toronto), Mackay, D., de Sieyes N.R. and M.D. Einarson. Assessing the impact of ethanol on MTBE and BTEX biodegradation using compound specific isotope analysis. **Invited Student Poster**. 2005 CNYAPG Symposium on Isotopic Geochemistry. Skeneatales NY. April 2005.
- Mancini, S.*, Ulrich, A. Sherwood Lollar, B., *Lacrampe-Couloume, G.*, and E. Edwards. Elucidating Pathways of Benzene Biodegradation In Subsurface Environments Using Carbon and Hydrogen Isotope Analysis. **Invited Student Poster**. 2005 CNYAPG Symposium on Isotopic Geochemistry. Skeneatales NY. April 2005.
- Sherwood Lollar, B., *Telling, J.P.*, *Lacrampe-Couloume, G.*, Fu, Q., Seyfried, Jr., W., Horita, J. and T.M. McCollom. Carbon and hydrogen isotope measurements in abiogenic hydrocarbon synthesis. **Invited**. 15<sup>th</sup> Annual V. M. Goldschmidt Conference, Moscow, ID. May 2005.
- Sherwood Lollar, B. Threats to Canadian Groundwater: Canadian Solutions for Hydrocarbon Pollution. **Invited**. Bacon & Eggheads lecture series to Members of Parliament. Ottawa ON. May 2005.
- Sherwood Lollar, B. Slater, G.F., Moser, D.P., Gihring, T.M., Telling, J., Lacrampe-Couloume, G., Lin, L.-H., and T.C. Onstott. Abiogenic gases, H<sub>2</sub>-based autotrophy and methanogens in the deep subsurface. **Keynote** for session on “Biogeochemistry at the Limits of Habitability”, American Chemical Society Annual Meeting, San Diego CA. March 2005.
- Sherwood Lollar, B. Unravelling abiogenic and biogenic sources of methane - Implications for the Earth’s deep biosphere and astrobiology. **Invited** Departmental Lecture. School of Geology and Geography. McMaster University. Hamilton ON. Feb. 2005
- Sherwood Lollar, B. Novel geochemical and isotopic techniques for delineating abiotic versus biotic sources of hydrocarbons in the subsurface. **Invited**. Canadian Mining Industry Research Organization (CAMIRO) - Exploration Division, Soil Gas Hydrocarbons Meeting. Toronto, ON. Dec. 2004
- Sherwood Lollar, B. Use of Compound Specific Stable Isotope Techniques for Quantification of Biodegradation Rates. **Keynote**. UNESCO Workshop on Transport and Fate of Diffuse Organic Contaminants in Catchments. GSF-Research Centre for Environment and Health, Munich Germany. Dec. 2004
- Sherwood Lollar, B. Stable Isotope Forensics: Promise and Pitfalls. **Invited**. Golder Associates Inc. Symposium on Innovative Strategies for Management of Contaminated Sites. Toronto, ON. Nov. 2004.
- Sherwood Lollar, B. Stable Isotope Environmental Geochemistry - Recent Advances. **Invited**. Fields Institute - Research in Mathematical Sciences Annual Conference for Fellows of the Royal Society Canada. Toronto, Ont. Oct. 2004.
- Sherwood Lollar, B. Geological and Geochemical Controls on the Earth’s Deep Biosphere. **Invited**. Canadian Institute for Advanced Research (CIAR) - Earth Systems Evolution Program Annual Meeting. Toronto, Ont. Sept. 2004.
- Sherwood Lollar, B. Stable Isotope Environmental Geochemistry - Recent Advances. **Keynote**. Notre Dame Environmental Education and Research Symposium. Dept. of Civil Engineering and Geological Sciences. University of Notre Dame, Notre Dame IN. Nov. 12, 2003.
- VanStone, N.*, *Prezprora, A.*, *Vogan, J.*, *Hart, S.* *Lacrampe-Couloume, G.*, *Mabury, S.* and B. Sherwood Lollar. Using stable carbon isotope analysis to assess the performance of an iron PRB for the remediation of TCE. **Invited**. Remediation Technology Development Forum. Niagara Falls, NY. Oct. 2003
- Sherwood Lollar, B. The origin of hydrocarbon gases in Precambrian environments. **Invited**. Dept. of Geological Sciences Departmental lecture series, Harvard University, Cambridge MA. Nov. 25, 2002.
- Sherwood Lollar, B. *G.F. Slater, Ward, J., Westgate, T. and G. Lacrampe-Couloume.* **Invited**. Canadian Institute of Mining Ore Deposits at Depth 2003 - Challenges and Opportunities. Gases and Fluids in the Precambrian Shield: Implications for Deep Mining. Timmins, ON Sept. 2003

- Sherwood Lollar, B. Deep Crustal gases and Fluids: Interactions with the Deep Biosphere. Hubbert Quorum on Hydrogeology. **Invited.** United States Geological Survey, Menlo Park, CA. Dec. 5, 2002.
- Sherwood Lollar, B. Compound Specific Isotope Analysis: A Novel Method of Assessment and Quantification of In Situ Remediation Potential. **Invited.** American Geophysical Union Fall Meeting. San Francisco CA. Dec. 6-10, 2002.
- Onstott, T.C., Lin, L.-H., Fredrickson, J.K., Moser, D.P., Gihrig, T.M., Brockman, F.J., Phelps, T.J., Pfiffner, S., Peacock, A., White, D.C., Kieft, T., McCuddy, S., Sherwood Lollar, B., Ward, J., Slater, G., Pratt, L.M., Boice, E., Fong, J. The Witwatersrand Deep Microbiology project: Observations pertaining to hypothetical microbial ecosystems beneath the surface of Mars. **Invited.** American Geophysical Union Fall Meeting. San Francisco CA. Dec. 6-10, 2002.
- Sherwood Lollar, B., Ward, J., Slater, G., Lacrampe-Couloume, G., Hall, J., Lin, L., Moser, D. and Onstott, T.C. Hydrogen and hydrocarbon gases in crystalline rocks: Implications for the deep biosphere. **Invited.** National Science Foundation Neutrinos and Subterranean Science Symposium, Washington D.C. Sept. 19-21, 2002.
- Sherwood Lollar, B. Deep crustal gases and fluids: Implications for the Deep Biosphere. **Invited.** Canadian Geoscience Council - Standing Committee on the International Continental Scientific Drilling Program - Scientific Drilling of the Sudbury Structure. Sept. 11-12, 2002.
- Sherwood Lollar, B. The origin of hydrocarbon gases in Precambrian environments. **Invited.** National Underground Science Laboratory Geomicrobiology Meeting. Lead, S.D. Nov. 29-30, 2001.
- Sherwood Lollar, B. **Key Note** New developments in isotopic tracers on contaminant degradation. **Key note.** The 3<sup>rd</sup> Asia-Pacific Symposium on Environmental Geochemistry. Guangzhou, China. Nov. 7-9, 2001.
- Sherwood Lollar, B. Applications of stable isotopes to investigate biodegradation of chlorinated ethenes. **Invited.** Department of Chemical Engineering and Chemistry. University of Toronto. Departmental Lecture Series. Oct. 2001
- Onstott, T.C., Moser, D.P., Pfiffner, S., White, D.C., Peacock, A., Phelps, T., DeFlaun, M.F., Hoek, J., Ghiorse, W.C., Colwell, F., Kieft, T., Reysenbach, A.-L., Fredrickson, J.K., Southam, G., Kotelnikova, S., Omar, G., Slater, G.F., Pratt, L.M., Boone, D. and Sherwood Lollar, B. **Invited.** Do superplumes select for hyperthermophiles in the deep subsurface. Earth Systems Processes - Global Meeting. Edinburgh. June 24-28, 2001.
- Sherwood Lollar, B. and Westgate, T. **Invited.** Carbon isotopic evidence for abiogenic synthesis of C1-C4 hydrocarbons in crystalline rock environments. Symposium on "Abiotic formation of organic species in hydrothermal systems: Catalytic and mineral-fluid equilibria" 11<sup>th</sup> Annual V. M. Goldschmidt Conference. Roanoke, Virginia, May 20-24, 2001.
- Sherwood Lollar, B. **Key Note** New developments in isotopic tracers on contaminant degradation. Symposium on "The Geochemistry of Contaminated Aquifers" 11<sup>th</sup> Annual V. M. Goldschmidt Conference. Roanoke, Virginia, May 20-24, 2001.
- Sherwood Lollar, B. Stable isotopic tracers for contaminant biodegradation. **Invited lecture** at Meteorological Service of Canada. Downsview, Ontario. Feb. 2001
- Slater, G.F., Sherwood Lollar, B., Sleep, B. and Edwards, E. Variability in carbon isotopic fractionation during biodegradation of chlorinated ethenes. **Invited.** American Geophysical Union Annual Meeting. San Francisco, CA. Dec 15-19, 2000.
- Sherwood Lollar, B. Earth surface processes and environmental science: A geologist's perspective. **Invited.** Geo Canada 2000 Summit Session. Annual Meeting of Geological Association of Canada. Calgary Alberta, May 2000.
- TC Onstott, DP Moser, H Dong, J.Fredrickson, FJ Brockman, TJ Phelps, SM Pfiffner, A Peacock, DC White, S Macnaughton, FS Colwell, DL Balkwill, MF DeFlaun, T Kieft, DR Boone, AL Reysenbach, J Hoek, GI Omar, WC Ghiorse, G Southam, G Slater, B Sherwood Lollar, S Kotelnikova, K Pedersen, L Pratt, J Fong, B Baker, C Wimpee, B MacGregor, S Fishbain, DA Stahl, M Stute, and R Hoover. (1999) The Witwatersrand Deep Microbiology Project: A Window Into the Extreme Environment of Deep Subsurface Microbial Communities. **Invited.** American Geophysical Union Fall Meeting. San Francisco CA. Dec.1999.

Sherwood Lollar, B., Slater, G.F., Ahad, J., Sleep, B. and Edwards, E. (1999) Use of stable carbon isotope to trace bioremediation of organic contaminants. **Invited Plenary**. 14th International Symposium on Environmental Biogeochemistry. Sept. 26-30, 1999. Deerhurst, Ontario, Canada.

Sherwood Lollar, B., Slater, G.F., Ahad, J., Sleep, B. M. Witt, G. Klecka, M. Harkness, J. Spivack (1999) Stable carbon isotope evidence for intrinsic bioremediation of tetrachloroethene (PCE) and trichloroethene (TCE) at Area 6, Dover Air Force Base. University Consortium on Solvents-in-Groundwater Fall Meeting. Hockley Valley Resort, Ontario (Sept. 1999). **Invited**.

Slater, G.F., Sherwood Lollar, B. Sleep, B. Edwards, E. and Lee, R.W. Isotopic fractionation associated with biodegradation of chlorinated hydrocarbons: laboratory and field results. University Consortium on Solvents-in-Groundwater Fall Meeting. Portland, Oregon (Oct. 1998). **Invited**.

Sherwood Lollar, B. Stable carbon isotopes - Tools for detection of the origin and fate of environmental contaminants. Geological Society of America Annual Meeting. Toronto. (Oct. 1998). **Invited**. (Oct. 1998)

Ballentine, C.J. and Sherwood Lollar, B. Origins of non-hydrocarbon gases in the Texas Panhandle and Hugoton gas fields. 8th Annual V.M. Goldschmidt Conference. **Invited**. Toulouse, France (Aug. 1998).

Sherwood Lollar, B. Tracing organic contaminants in groundwater using compound specific isotope ratio mass spectrometry (GC/C/IRMS). University Consortium on Solvents-in-Groundwater Fall Meeting. Toronto, Ont. **Invited**. (Oct. 1997).

Slater, G.F., Dempster, H. and Sherwood Lollar, B. Headspace equilibration applied to isotopic analysis of low level dissolved organic contaminants. University Consortium on Solvents-in-Groundwater Fall Meeting. Toronto, Ont. **Invited**. (Oct. 1997).

Plus 44 more invited and other lectures in the previous 10 years.

## **12. THESES SUPERVISED** (I am primary supervisor for all those listed except where indicated with \*, indicating joint supervision)

### **High School Co-op Education Students**

**Mark Janelle** Jan-June 2005

### **NSERC USRA Summer Students**

**S. Desrocher** (Geology) (1994 and 1995)

**C. Norcross** (Geology) (1995)

**J. Gray** (Geology) (2000)

**C. Hunter** (Geology) (2000)

**S. Hirschorn** (Geology) (2001)

**A. Pierce** (Geology) (2002)

**M. Chartrand** (Chemistry) (2002)

**J. Liu** (Chemistry) (2008)

**C. Chan** (2009 and 2010)

**S. Yang** (2011) NSERC Create Scholarship via Canadian Astrobiology Training Program (CATP)

### **Undergraduate Summer Students**

**Crystal Beaudoin** (2010)

### **4th Year Research Theses:**

Isotopic and geochemical constraints on landfill CH<sub>4</sub>, Beare Rd Landfill, Metro Toronto

**S. Desrocher** (1994-1995) Dept. of Geology

Isotopic and compositional effects of bacterial oxidation of volatile n-alkanes

**C. Norcross** (1994-1995) Dept. of Geology

Hydrogen isotope fractionation during anaerobic biodegradation of toluene

**J. Ward** (1999-2000) Dept. of Geology

Stable carbon isotopes as an indicator of natural attenuation of EDC

**S. Mancini** (1999-2000) Dept. of Geology

Presence of H<sub>2</sub> gas in deep mine gases from Canada and South Africa

**P. Kral** (2003-2004) Dept. of Geology

Development of GC-IRMS techniques for CSIA analysis of pesticides

**C. Rose** (2007-2008) Dept. of Chemistry

***Masters Students:***

Biofilm development in groundwaters of the Canadian Shield

**F. Doig** (1994)

The role of N<sub>2</sub> and H<sub>2</sub> in abiogenic methanogenesis

**J. Montgomery** (1994)

Isotopic discrimination between inorganic and organic carbon pools in modern microbial mats

**G. Slater** (1996) Holder of:

**University of Toronto Open Scholarship 1994-95**

**Ontario Graduate Scholarship 1995-97.**

**NSERC PGS Scholarship 1997-99.**

Origin, transport and fate of natural hydrocarbon gases in near-surface groundwaters

**S. Taylor** (1996) Holder of:

**University of Toronto Open Scholarship 1995-96**

**American Association of Petroleum Geologists Grants in Aid of Field Work (\$2000)**

Evaluation of GC-C-IRMS techniques to identify multi-sources of organic contaminants in groundwater systems

**H. Dempster** (1997) Holder of:

**NSERC PGS Scholarship 1995-97**

**Travel Scholarship from American Geophysical Union Spring Meeting, Baltimore 1996.**

CH<sub>4</sub> gas and associated groundwaters at Kidd Creek Mine, Timmins, Ont.

**T. Westgate** (1998) Holder of:

**University of Toronto Open Scholarship 1997-98**

Use of carbon isotope signatures as tracers of intrinsic remediation of aromatic hydrocarbons

**J. Ahad** (2000) Holder of:

**NSERC PGS Scholarship 1998-2000.**

Stable carbon isotopic signatures of biodegradation of chlorinated hydrocarbons in column experiments

\***A. Brown** (2000) Holder of:

**OGSST Scholarship 1999-2000**

Jointly supervised with Dr. B. Sleep of Dept. of Civil Engineering, University of Toronto

Carbon, hydrogen and oxygen isotopes as a means of assessing biodegradability of MTBE

**J. Gray** (2002)

**University of Toronto Open Graduate Scholarship 2000-2001**

**NSERC PGS Scholarship 2001-2002**

C and H isotope applications to intrinsic bioremediation of aromatic hydrocarbons

**S. Mancini** (2002)

**University of Toronto Open Graduate Scholarship 2000-2002**

CH<sub>4</sub> and higher hydrocarbons in the Witwatersrand, South Africa deep gold mines

**J. Ward** (2002)

Investigation of Aerobic and Anaerobic Biodegradation of Ethene using Compound Specific isotope Analysis

**Tiffany Johnson** (2009)

**University of Toronto Entrance Scholarship 2007**

**NSERC PGS Scholarship 2008**

Application of Compound Specific Carbon and Hydrogen Isotopes to Monitor Biodegradation of Monoaromatic Hydrocarbons  
**Micheal Howlett** (2008)  
**OGSST Scholarship 2007-2008**

**Stephanie Tille** 2006-2008 (all thesis work completed but student has not written up thesis)  
**Holder of Connaught International Student Scholarship for 2006-2007**

Non-Rayleigh compound specific isotope fractionation for TCE  
**Lisa Douglas** (2010)

Carbon isotope fractionation during biodegradation of chloroform  
**Calvin Chan** Starting date Sept. 2010  
**Explorer's Fund Scholarship**  
**Ontario Graduate Scholarship**  
**Massey College Junior Fellow**

*PhD Students:*

Constraining the fate of chlorinated ethenes in groundwater systems  
using stable carbon compound specific isotope analysis

**G. Slater** (2000)  
**NSERC PGS Scholarship 1996-98**  
**University of Toronto Open Graduate Scholarship 1998-2000**

G. Slater won the **D.N. Chorafas Foundation Prize** for his PhD. He also won an **NSERC Postdoctoral Fellowship** and a prestigious **Woods Hole Oceanographic Institution Fellowship**. He is currently the **Canada Research Chair** in Environmental Isotope Geochemistry at McMaster University.

Development of groundwater flow models incorporating isotopic tracers of biodegradation and attenuation

**P. Morrill** (2004)  
**University of Toronto Open Graduate Scholarship 1999-2001**  
**OGSST Scholarship 2002-2004**

Won the prestigious Carnegie Institute (Washington) DC Postdoctoral Fellowship and NSERC Postdoctoral Fellowship.  
Currently Assistant Prof. Memorial University of Newfoundland

Isotopic constraints on abiotic degradation mechanisms for chlorinated hydrocarbons

**\*N. van Stone** (2005)  
**University of Toronto Open Graduate Scholarship 1999-2000**  
**CresTECH Industrial Scholarship 2001-2003**

Jointly supervised with Dr. S.A. Mabury of Dept. of Chemistry, University of Toronto

Stable isotope investigations of biodegradation of chlorinated aromatic compounds.

**S. Hirschorn** (2007)  
**University of Toronto Open Graduate Scholarship 2001-2002**  
**NSERC PGS Scholarship 2003-2005**  
**Canadian Society for Petroleum Geology Regional Graduate Award 2004-2005**  
**Ontario Graduate Scholarship 2005-2006**

Stable isotope investigations of biodegradation of aromatic compounds

**S. Mancini** (2007)  
**NSERC PGS Scholarship 2002-2004**  
**Mary H. Beatty Award 2003-2004** (Faculty of Arts & Science, University of Toronto)  
**American Petroleum Institute/National Ground Water Association Scholarship 2003-2004**  
**Canadian Society for Petroleum Geology Regional Graduate Award 2003-2004**  
**Ontario Graduate Scholarship 2005-2006**  
**American Association of Petroleum Geologists Student Research Grant 2005**  
**GSA Graduate Research Grant** (Awarded Outstanding mention for the top 19 of 800 applications)

Biodegradation of organic contaminants in arctic environments

**J. Gray McKelvie** (2006)

**NSERC PGS 1 Scholarship 2002-2003**

**American Petroleum Institute/National Ground Water Association Scholarship 2002-2003**

**NSERC Canada Graduate Scholarship 2003-2005**

**2003 Institute for Environmental Studies Labatt Award for Excellence**

**American Petroleum Institute/National Ground Water Association Scholarship 2006**

**OGSST J.J. Fawcett Graduate Scholarship 2005-2006**

Held 2007-2008 Ontario Post-Doctoral fellowship at UTSC, NSERC Postdoctoral Fellowship 2008-2010 and L'Oreal Postdoctoral Fellowship 2009-2010.

Isotopic tracers of VC biodegradation in the environment

**M. Chartrand** (2007)

**NSERC PGS Scholarship 2002-2004**

**American Petroleum Institute/National Ground Water Association Scholarship 2004-2005**

Co-inhibition effects of TCE and TCA biodegradation investigated using CSIA

**Lisa Douglas** (started 2010)

**OGSST Scholarship 2010-2011**

Biodegradation pathways for chlorinated aromatics

**Mathieu Morin** (starting date May, 2011)

*Co-supervised Graduate Students:*

**Guillaume Lamarche-Gagnon** (co-supervised with Dr. Lyle Whyte under NSERC CREATE Canadian Astrobiology Program)  
McGill University MSc. 2010 to present

**Danielle Simkus** (co-supervised with Dr. Greg Slater under NSERC CREATE Canadian Astrobiology Program)  
McMaster University MSc Sept. 2011 to present

**Natalia Ivdra** (co-supervised with Dr. A. Fischer and I. Nijenhuis)  
UFZ-Leipzig PhD May 2011 to present

*Postdoctoral Fellows:*

**Dr. J.M. Lansdown** - Dec. 1992 to March 1995.  
Current position - Research Associate, University of Texas, Austin TX

**Dr. Grace Aye** - Sept. to Dec. 1994.  
Current position - Chemist - City of London, Ontario, Canada

**\*Dr. C. Wong** - Oct. 1999 to July 2002  
**U.S. Environmental Protection Agency Bronze Medal for Commendable Service (2000).**  
Jointly supervised with Dr. S.A. Mabury of Dept. of Chemistry, University of Toronto  
Current position - Dept. of Chemistry, Assist. Professor, University of Alberta

**Dr. G.F. Slater** - Jan. 2001-April 2001.  
Radiocarbon dating of hydrocarbon gases from Witswatersrand Basin, South Africa  
**NSERC Postdoctoral Fellow** and Woods Hole Oceanographic Institution Fellow, Woods Hole Oceanographic Institution  
Falmouth, MA USA  
**Current position - Canada Research Chair** in Environmental Isotope Geochemistry - McMaster University, Hamilton, ON

**Dr. M. Elsner** - Jan. 2004 to Jan.2006  
Modeling primary and secondary isotope effects during degradation of CT  
**Swiss National Science Foundation Postdoctoral Fellowship 2004-2006**

Present Position Helmholtz Association Professorial Position  
GSF National Research Center for Environment and Health, Munich Germany

**Dr. J. Telling** - Sept. 2004 to Sept. 2006

NASA Astrobiology Institute - Biosustainable Energy and Nutrient Cycles  
in the Deep Subsurface of Earth and Mars

**Dr. K. Voglesanger** - May 2006 to July 2008

NASA Astrobiology Institute - Biosustainable Energy and Nutrient Cycles  
in the Deep Subsurface of Earth and Mars

**Dr. I. Jabeen** - Nov. 2007 to Dec. 2008

Isotopic analysis of carbon isotopes in methane from fluid inclusions - analytical development

**Dr. J. Moran** May 2007 to Jan 2009 (co-supervised with Dr. G.F. Slater McMaster University)

NASA Astrobiology Institute - Biosustainable Energy and Nutrient Cycles  
in the Deep Subsurface of Earth and Mars

**Dr. X. Liang** - Starting date June 2009

Abiotic and biotic fractionation comparison to reveal mechanisms of PCE degradation

**Dr. Scott Mundle** - Starting date May 1, 2010

Compound specific isotopes as natural probe for reaction chemistry

**Dr. Long Li** - Starting date October 2009

Nitrogen cycling in the deep subsurface biosphere

NSERC CREATE PDF Fellowship through CATP (Canadian Astrobiology Training Program)

**Currently hired as CRC Chair Tier II University of Alberta**

**Senior Research Associate:**

Dr. G. Lacrampe-Couloume - Sept. 1999 to present

**Junior Research Associate:**

Dr. T. Eckert - Jan. 2009-March 2010

**Laboratory Technician and Manager**

Min Wong - Sept. 2004-Aug. 2005

J. Heidenheim - Sept. 2005-Aug. 2007

C. Heidorn - Jan. 2009-March 2010

K. Chu – Sept. 2011 to present

**Graduate Supervisory Committee member for:**

**A. Vandersteen** - (PhD - Chemistry) Supervisor: R. Kluger **2009 to present**

**B. Xu** - (PhD – Civil Engineering) Supervisor: B. Sleep **2009 to present**

**P. Chandra** (MSc - Geology) Supervisor: B. Bergquist **2009-2010**

**C. Rose** - (MSc - Geology) Supervisor: B. Bergquist **2008-2010**

**J. Longstaffe** - (PhD - Chemistry) Supervisor: A. Simpson **2008 to present**

**S. Mundle** - (PhD - Chemistry) Supervisor: R. Kluger **2007-2010**

**S.J. Brown** - (PhD - Chemistry) Supervisor: M. Simpson **2006-2010**

**C. Washer** - (PhD - Chemical Eng. And Applied Chemistry) Supervisor: E. Edwards **2006 to present**

**K. Torayk** - (PhD - Geology) Supervisor: F.G. Ferris **2006-2010**

**T. Eckert** - (PhD - Geology) Supervisor: U. Wortmann **2004-2009**

**J. Dinglasan** - (PhD - Chemistry) Supervisor: S. Mabury and E. Edwards **2002-2006**

**Natasa Draculic** – (PhD - Geology) Supervisor: M. Douglas **2002 to present**

**Natalie Caciagli** - (PhD - Geology) Supervisor: J. Brennan **2001-2009**

**U. Basuki** - (PhD - Geology) Supervisor: E. Spooner **2001-2006**

**C. Shunthirasingham** - (MSc - Chemistry) Supervisor: M. Simpson **2004-2005**

**Yvonne Litwin** - (PhD - Geology) Supervisor: F.G. Ferris **2001-2003**  
**Darlene Lim** – (PhD - Geology) Supervisor: M. Douglas **1999-2003**  
**Jonathan Dupe** – (PhD - Geology) Supervisor: J. Rucklidge **1996-2001**  
**Roger Moss** - (PhD - Geology) Supervisor: S. Scott **1996-2000**  
**Rick Gerber** (PhD - Geology) Supervisor: K.W.F. Howard **1995-98**  
**Richard Taylor** (PhD - Geology) Supervisor: K.W.F. Howard **1995-97**  
**Xia Li** (MSc - Geology) Supervisor: G. Anderson **1995-97**  
**Nurudin Ladah** - (MSc - Geography) Supervisor: J. Gerits. **1995-97**

## **V. ADMINISTRATIVE ACTIVITIES**

### ***13A. COMMITTEES AND ORGANIZATIONS WITHIN THE UNIVERSITY***

University of Toronto Governing Council 2003-2007  
University of Toronto Governing Council Executive Committee 2004-2007  
University of Toronto Academic Appeals Committee 2006-2007  
University of Toronto Academic Priorities and Planning 2004-2005  
University of Toronto Academic Board 2001-2004  
Faculty of Arts and Science Senior Promotions Committee 2002-2005  
Faculty of Arts and Science Awards Advisory Committee 2011-2013

Natural Sciences and Engineering Panel of the Research Advisory Board, University of Toronto  
Office the Vice-President, Research and International Relations (1999 to 2002)

Departmental Committees (1992-2011):

- Undergraduate Curriculum Renewal Committee
- Graduate Affairs Committee
- Graduate Awards and Admissions
- Undergraduate Affairs Committee
- Safety Committee
- Public Relations and Curriculum Advisory to Students Committee
- Promotions Committee
- Academic Appeals

Member of Search Committees for:

- Chairman - Department of Geology 1995
- Tenure Stream Appointment in Environmental Geosciences (Geology) 1995
- Tenure Stream Appointment in Mathematics - Dean's representative 1997
- Tenure Stream Appointment in Structural Geology (Geology) 1999
- Chairman - Department of Geology 2000
- Canadian Research Chair Tier II Appointment in Climate Change 2002
- Senior Lecturer Position 2002
- Chairman - Department of Chemistry 2003
- Chairman - Department of Physics 2004
- Director - Dunlap Institute, University of Toronto 2009-2010
- Chair, Department of Geology 2011
- Graduate Three Campus Chair, Department of Geology 2011

Chair of Third Year Review for Dr. J. Mungall (Geology 2001) and Dr. J. Bollmann (Geology 2007)

Member of Third Year review Committee Dr. J. Murphy, Dept. of Chemistry (2009)

Member Reading Committee for Tenure for Dr. J. Bollmann (2010)

Member Reading Committee for Promotion to Full Professor for Dr. M. Simpson (2011)

Tenure Committee Member

- M.S.V. Douglas Dept. of Geology (1999)
- K. Strong, Dept. of Physics (2000)
- J. Brenan Dept. of Geology (2002)

G. Srinivasan Dept of Geology (2008)

C.-J. Banks Dept. of Geology (2008)

Dept. of Geology Coordinator on Planning Committee for 'Discover Science Day' 1993 and 1994  
and for Take our Daughters to Work Day 1996-98

Faculty of Art and Science - Women in Science Committee Member 1994-96 and 1998-99.

Royal Canadian Institute - Joint Session with the University of Toronto  
Panel Discussion: Women Scientists - Current Issues and Realities

Faculty of Arts and Science Women in Academe Annual Forum - Guest Speaker in 1997, 1999 and 2000.

### **13B. COMMITTEES AND ORGANIZATIONS OUTSIDE THE UNIVERSITY**

(see also **Professional Affiliations and Activities** p. 2-3)

#### **Organizer of Special Theme Sessions:**

1. Geological Society of America Annual Meeting 1997 (Salt Lake City, Utah)  
"New isotopic tools for detection of the origin and fate of environmental contaminants"  
Chairs: B. Sherwood Lollar and T.A. Abrajano
2. Geological Society of America Annual Meeting 1998 (Toronto, Ontario)  
"Origin of non-hydrocarbon gases in sedimentary basin systems"  
Chairs: B. Sherwood Lollar and C.J. Ballentine
3. Geological Society of America Annual Meeting 1998 (Toronto, Ontario)  
Organic Geochemical Division (OGD) of the Geochemical Society (GS) Symposium:  
"Research Issues in Petroleum and Environmental Organic Geochemistry"  
Chairs: B. Sherwood Lollar and M. Lewan
4. Goldschmidt 2000 (Oxford, UK)  
Chemistry and Microbiology of Pollution" Special Symposium  
Chairs: B. Sherwood Lollar and A. Bath
5. 8<sup>th</sup> International In Situ and On Site Bioremediation Symposium June 2005 (Baltimore)  
"Tools/Techniques for Chlorinated Solvent Sites" Session  
Chairs: B. Sherwood Lollar and C.M. Aelion.
6. 9<sup>th</sup> International In Situ and On Site Bioremediation Symposium June 2007 (Baltimore)  
"Microbial Ecology of Reductive Dechlorination and the pH Impact" Session  
Chairs: B. Sherwood Lollar and C.M. Aelion
7. Executive Program Committee Co-Chair - Goldschmidt 2008 Vancouver, BC July 2008  
Chairs: R. Carlson and B. Sherwood Lollar
8. CIFAR (Canadian Institute for Advanced Research) Workshop I on Astrobiology, Toronto ON. April 2009  
Chairs: G.F. Slater, B. Sherwood Lollar, R. Pudritz, C. Suttle, L. Whyte
9. International Program Committee Co-Convenor - Goldschmidt 2009 Davos CH June 2009  
Theme: Earth's Resources I: Origin and Sustainable Exploitation of Oil/Water/Gas Systems
10. Program Committee ABSCICON 2010 Galveston TX. April 2010.
11. CIFAR (Canadian Institute for Advanced Research) Workshop I on Astrobiology, Toronto ON. Oct. 2010  
Chairs: G.F. Slater, B. Sherwood Lollar, R. Pudritz, C. Suttle, L. Whyte
12. Sloan Foundation Deep Carbon Observatory Workshop, Carbon Cycling in the Deep Crustal Biosphere  
University of Free State, Bloemfontein South Africa, Jan. 2011  
Organizers: B. Sherwood Lollar, T.C. Onstott, E. van Heerden and T. Kieft
10. Battelle International Symposium on Bioremediation and Sustainable Environmental Technologies, Reno, NV. June 2011.B.  
Organizers: B. Sherwood Lollar and T. Buscheck (Chevron) Co-Chairs  
Special session on **Compound Specific Isotope Investigations at Contaminated Field Sites.**
11. Origins 2011 Joint Meeting of the ISSOL (International Astrobiology and Origins of Life Society) and Bioastronomy Society. Montpellier, FR. July 2011. Session Chair and Best Poster Judge.

#### **Peer Reviewer:**

- i) Granting Agencies - NASA, ESTCP/SERDP, NSERC, EPA, DOE, NSF, United States Geologic Survey
- ii) Scientific Journals - Geochimica Cosmochimica Acta  
- Environmental Science and Technology

- Journal of Contaminant Hydrogeology
- Organic Geochemistry
- Chemical Geology
- Science
- Nature
- Nature Geoscience

### **Memberships**

Geological Society of America  
 National Groundwater Association  
 American Geophysical Union  
 Organic Geochemistry Society  
 American Chemical Society

## **F. OTHER RELEVANT INFORMATION**

**PUBLIC LIAISON** in 1999-2011 took the form of a number of popular articles/interviews that appeared in the press and highlighted my research in environmental geochemistry, storage and transport of carbon dioxide in the subsurface, and abiogenic hydrocarbon gas formation and deep subsurface microbiology in Precambrian rocks. These included:

- March 2011 **CBC radio Quirks and Quarks: World's Oldest Water**- based on our recent publication on billion year old Neon in deep groundwaters. Day after interview the story had the record for most hits on CBC website.
- Feb. 2011 44 stories in media on **World's Oldest Water** (based on our recent publication on billion year old Neon in deep groundwaters) including Spiegel on-line, Norwegian broadcasting Corporation, Australian Broadcasting Corporation (radio interview) and story in MICROBE (popular science magazine)
- Feb. 2011 Panelist "Science without Borders" Press Breakfast. AAAS Annual Meeting. Washington D.C. Feb. 2011
- Dec. 2010 CTV Evening News – Commentary on discovery of Weird Life – Mono Lake Arsenate bacterium
- Nov. 2010 Vancouver Institute. University of British Columbia. "Can Carbon Capture and Storage Solve (or Reduce) Global Climate Change: Lessons from Nature"? Vancouver BC.
- May 2010 Highlighted in University of Toronto's publication "**Ideas that could Change the World**"
- March 2010 Panelist on Judging Panel for Weston Innovation Youth Award in Science sponsored by Ontario Science Centre
- Feb 2010 Australian Broadcasting Corporation: Interview for Science Radio program on carbon sequestration
- Nov. 2009 Massey College University of Toronto Science and Medicine Round Table "Follow the Water". Toronto ON
- Oct. 2009 Royal Society of Canada International Year of Astronomy Symposium - The Universe and Our Place in it. Invited Presentation at Canada Museum of Science and Technology, Ottawa. "Astrobiology - Life on Earth and Beyond?"
- April 2009 Press related to Nature Cover story included Canada Press, Quirks and Quarks, CBC Radio morning shows in Calgary and Edmonton, and international coverage by the BBC, The Independent, Reuters, El Pais, Chemical Engineering News and News and Views piece in Nature
- April 2009 Introduction and Q&A for new IMAX film at Ontario Science Centre
- March 2009 Panelist on Judging Panel for Weston Innovation Youth Award in Science sponsored by Ontario Science Centre
- Feb 2009 Press related to publication of U.S. Environmental Protection Agency (EPA) White paper on Compound Specific Isotope Analysis Press included stories in U of T Bulletin; HazMat Journal and Chemical News
- Jan. 2009 Girls Rock Science - High School Outreach Program at U of Toronto "Astrobiology - Beyond the Men in Black"
- Nov. 2008 Public Lecture sponsored by U of T Alumni : "Threats to Canadian Groundwater"
- May 2008 Introduction and Q&A for new IMAX film at Ontario Science Centre
- May 2008 John Fisher Public School - 4th Grade presentation
- Jan. 2008 Girls Rock Science - High School Outreach Program at U of Toronto "Astrobiology - Beyond the Men in Black"
- November 2007 Public Lecture at UTSC to Alumni on ancient microbial communities found at 2.8 kmbs in South Africa gold mine
- Aug. 2007 PBS - Sloan Foundation documentary film crew accompanies our field team in the deep subsurface Kidd Creek Mine (Timmins ON)
- January 2007 Public Lecture to Attached High School of Ochanomizu University of Tokyo, Japan.  
**Royal Society of Canada - Science Council of Japan WISSET Invited Lecture.**
- December 2006 **Ripley's "Believe it or not" Editorial** cartoon runs throughout North American newspapers highlighting our *Science* paper by Lin et al., 2006 on ancient microbial communities found at 2.8 kmbs in South Africa gold mine
- October 2006 **CBC radio Quirks and Quarks** - Interview our *Science* paper by Lin et al., 2006 on ancient microbial communities found at 2.8 kmbs in South Africa gold mine
- Aug. 2006 **Toronto Star** feature on our research on deep subsurface biosphere and origin of methane
- July 2006 **CBC Radio** Interview - NASA searches for life on Mars deep in the Canadian Shield
- July 2006 **Timmins Daily Press** Kidd Creek Mine: NASA search for extraterrestrial life

April 2006 **Canadian Space Agency** - New research on terrestrial analogue sites for space studies

April 2006 **Canadian Chemical News** highlights our work "Countering the hydrocarbon threat - sources and remediation of Canada's groundwater contamination"

October 2005 **Geotimes** - published by the American Geological Institute - interview and photo on our research on abiogenic hydrocarbons

April 4, 2005 **Chemical and Engineering News** - Details of Sherwood Lollar American Chemical Society Invited Talk in Session of Biogeochemical Limits of Habitability highlighted

April 2005 Coordinated 4<sup>th</sup> grade visit to U of T - St. Bridget's Catholic School - Toronto District Separate School Board

April 2005 4<sup>th</sup> grade talk on geology - John Fisher Public School - Toronto District School Board

March 2005 Seminar on science careers - Linden School Toronto

Feb. 2005 **BBC Radio** - Interview by lead author C.J. Ballentine on our research on neon isotopes and mantle-derived gases and related publication in *Nature*

Jan. 2005 **CBC Radio - Quirks and Quarks** - Interview on our research on neon isotopes and mantle-derived gases and related publication in *Nature* by Ballentine et al., 2005

Nov. 2004 **Geotimes** - published by the American Geological Institute - interview on abiogenic hydrocarbons p. 11 "Taking the fossil out of fuels"

Sept. 2004 **New York Times** interview - Petroleum from decay? Maybe not, study says (Tues. Sept. 14, 2004); additional interview on same topic for **ScienceOnline** (website for the leading scientific publication *Science*)

May 2003 **Scientists in Schools** - Toronto Separate School Board of Education

Nov. 2002 **American Association of Petroleum Geology** Explorer "Gas Origin Theories to be Studied"

July 2002 **Canadian Chemical News** - The Chemical Institute of Canada

Apr. 8, 2002 **U of T Bulletin** "Geochemist identifies origin of mysterious gases"

Apr. 6, 2002 **CBC Radio - Quirks and Quarks** - Interview on my research on abiogenic hydrocarbons and related publication in *Nature*

Apr. 5, 2002 **NATIONAL POST** - Article by J. Bryan "Canadian Shield Mystery Solved - U of T Mine Gas Study"

Apr. 5, 2002 Online german version **Scientific American** (<http://www.wissenschaft-online.de>) "Canadian Shield Mine gas study"

Apr. 5, 2002 **National GeographicWebsite** (<http://news.nationalgeographic.com/>) story by B. Trivedi "Earth gases may provide clues to evolution of life"

Apr. 5, 2002 **Radio CKTB** Niagara "Drive at Five" Interview

Apr. 4, 2002 **Discovery TV** - Interview on my research on abiogenic hydrocarbons and related publication in *Nature* on "@discovery.com" show

Feb. 2002 University of Toronto publication on research = "**The Edge**" - profiled in cover story on environmental research at University of Toronto

Sept. 5, 2001 Globe and Mail - - Natural Science and Engineering Council insert - "They don't walk on water but ..". NSERC research initiatives in environmental water research.

Sept. 5, 2001 La Presse - Natural Science and Engineering Council insert - "They don't walk on water but ..". NSERC research initiatives in environmental water research. French language version of same

Sept. 1999 **TIME** Magazine - Canada Edition - Profiled as one of 25 "Leaders for the 21<sup>st</sup> Century"

Sept. 1999 **CBC Radio Metro Morning** Interview

Sept. 1999 **CBC Radio Ontario Morning** Interview

Sept. 1999 S&T Post, the official newspaper of the Department of Science & Technology (DOST), Philippines.

Sept. 1999 Technology News section of **Pollution Engineering** magazine.

Sept. 1999 Physics Today (scientific periodical). Scientific profile of my research program

Sept. 1999 **Environment News** - Environmental Sciences newsletter of *Organic Geochemistry*

May 1999 NSERC Tribute to Research Excellence

Apr. 12, 1999 **University of Toronto Bulletin** "Process to benefit groundwater cleanup".

Mar. 31, 1999 **NATIONAL POST** article "A new technique measures bacteria's progress in pollution" by A. Lamey

Spring 1999 NSERC Issue of **Contact**