

Curriculum Vitae (August 2017)

Owen A. Sherwood, Ph.D.

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Research Interests

- Stable isotope geochemistry and amino acid biomarkers
- Ecology and geology of deep-sea corals
- Paleoceanography and marine productivity
- Petroleum geology and environmental impacts of unconventional resource development
- Global greenhouse gas methane emissions

Education

- Ph.D. (Earth Sciences), Dalhousie University, Halifax, Canada, July 2006. Thesis: Deep-Sea Octocorals: Dating Methods, Stable Isotopic Composition, and Proxy Records of the Slopewaters off Nova Scotia. Supervisor: Dr. David B. Scott.
- M.Sc. (Geology), McMaster University, Hamilton, Canada, October 2002. Thesis: The Deep-Sea Gorgonian Coral, *Primnoa Resedaeformis*, as an Oceanographic Monitor. Supervisor: Dr. Michael J. Risk.
- B.Sc. (Geology), McMaster University, Hamilton, Canada, April 2000. Thesis: Isotopic Smoke Signals and El Niño Related Stress in Java Sea Corals. Supervisor: Dr. Michael J. Risk.

Professional Experience

- July 2017 – present: **Assistant Professor**, Earth Sciences, Dalhousie University, Halifax, NS, Canada.
- July 2017 – present: **Adjunct Professor**, INSTAAR, University of Colorado, Boulder, USA.
- Oct 2013 – present: **Faculty Research Associate**, INSTAAR, University of Colorado, Boulder, USA. Stable isotope instrumentation and method development; global and regional atmospheric methane budgets; impacts of oil&gas development on air and water quality.
- Oct 2011 – Sep 2013: **Petroleum Geoscientist and Laboratory Manager**, Dolan Integration Group, Boulder, USA. Built a commercial laboratory for compound-specific stable isotopic characterization of hydrocarbon gases; consulted on hydrocarbon reservoir maturity, migration, compartmentalization, and contaminant tracing for industry clients.
- May 2011 – Oct 2011: **Postdoctoral Fellow**, Ocean Sciences Dept., University of California, Santa Cruz, USA. Development of amino acid-specific stable isotope techniques as tracers of marine biogeochemical cycles. Supervisor: Dr. Matthew McCarthy.
- 2009 – 2011: **Reservoir Geoscientist**, Imperial Oil, St. John's and Calgary, Canada. Exploration/Development/Production of conventional and unconventional hydrocarbon plays of the Jeanne d'Arc and Western Canada Sedimentary Basins.

- 2008: **Postdoctoral Fellow**, Dept. of Earth Sciences, Memorial University of Newfoundland, St. John's, Canada. Experimental Ichnology and the effects of burrowing organisms on hydrocarbon reservoir quality. Supervisor: Dr. Duncan McIlroy.
- 2008: **Endeavour Research Fellow**, CSIRO Marine and Atmospheric Research, Hobart, Australia. Development of paleoceanographic proxies from deep-sea corals of the Southern Ocean. Supervisor: Dr. Ron Thresher.
- 2006 – 2008: **NSERC Postdoctoral Fellow**, Dept. of Biology, Memorial University of Newfoundland, St. John's, Canada. Biogeochemistry of Northwest Atlantic deep-sea corals: Application to paleoceanography and marine conservation. Supervisor: Dr. Evan Edinger.

Fellowships, Scholarships and Awards

- 2008: Australian Endeavour Research Fellowship. \$20,000 AUD.
- 2006 – 2008: NSERC Postdoctoral Fellowship. \$80,000 CAD.
- 2006: NSERC Visiting Fellowship in Canadian Government Laboratories Program. \$43,000 (declined).
- 2005: Dalhousie Student Travel Grant. \$1,000 CAD.
- 2003 – 2005: NSERC Postgraduate Scholarship. \$46,000 CAD.

Journal Articles

25. **Sherwood OA**, Schwietzke S, Arling VA, Etiope G (2017) Global inventory of gas geochemistry data from fossil fuel, microbial and biomass burning sources, version 2017. *Earth System Science Data*. 9: 639-656.
24. Lopez M, **Sherwood OA**, Dlugokencky EJ, Kessler R, Girouz L, Worthy D (2017) Isotopic signatures of anthropogenic CH₄ sources in Alberta Canada. *Atmospheric Environment*, 164: 1280-288.
23. Lackey G, Rajaram H, **Sherwood OA**, Burke TL, Ryan JN (2017) Surface casing pressure as an indicator of well integrity loss and stray gas migration in the Wattenberg field, Colorado. *Environmental Science and Technology*, 51: 3567-3574.
22. Schwietzke S, **Sherwood OA**, Bruhwiler LMP, Miller JB, Etiope G, Dlugokencky EJ, Michel SE, Arling VA, Vaughn BH, White JWC, Tans PP. Upward revision of global fossil fuel methane emissions based on isotope database. *Nature* 538: 88-91.
21. **Sherwood OA**, Rogers JD, Lackey G, Burke TL, Osborn SG, Ryan JN. Groundwater methane in relation to oil and gas development and shallow coal seams in the Denver-Julesburg Basin of Colorado. *Proceedings of the National Academy of Sciences* 113(30): 8391-8396.
20. McMahon KW, McCarthy MD, **Sherwood OA**, Larsen T (2015) Millennial-scale plankton regime shifts in the subtropical North Pacific Ocean. *Science* 350: 1530-1533.
19. Schiff JT, Batista FC, **Sherwood OA**, Guilderson TP, Hill TM, Ravelo AC, McMahon KW, McCarthy MD (2014) Compound specific amino acid $\delta^{13}\text{C}$ patterns in a deep-sea proteinaceous coral: Implications for reconstructing detailed $\delta^{13}\text{C}$ records of exported primary production. *Marine Chemistry* 166: 82-91.

18. **Sherwood OA**, Guilderson TP, Batista FC, Schiff JT, McCarthy MD (2014). Increasing subtropical North Pacific Ocean nitrogen fixation since the Little Ice Age. *Nature* 505: 78-81 (+ cover illustration).
17. Edinger EN, **Sherwood OA** (2012) Applied taphonomy of gorgonian and antipatharian corals in Atlantic Canada: experimental decay rates, field observations, and implications for assessing fisheries damage to deep-sea coral habitats. *Neues Jahrbuch für Geologie und Paläontologie-Abhandlungen* 265(2): 199-128.
16. Edinger EN, **Sherwood OA**, Piper DJW, Wareham VE, Baker KD, Gilkinson KD, Scott DB (2012) Geological features supporting deep-sea coral habitat in Atlantic Canada. *Continental Shelf Research* 31(2): S69-S84.
15. **Sherwood OA**, Lehman M, Schubert C, Scott DB, McCarthy MD (2011) Nutrient regime shift in the Western North Atlantic indicated by compound-specific $\delta^{15}\text{N}$ of deep-sea corals. *Proceedings of the National Academy of Sciences* 108: 1011-1015.
14. **Sherwood OA**, Lapointe BE, Risk MJ, Jamieson R (2010) Nitrogen isotopic records of terrestrial pollution encoded in Floridian and Bahamian gorgonian corals. *Environmental Science and Technology* 44: 874-880.
13. Herringshaw L, **Sherwood OA**, McIlroy D (2010) Ecosystem engineering by bioturbating polychaetes in event bed microcosms. *Palaeos* 25: 46-58 (+ cover illustration).
12. **Sherwood OA**, Thresher RE, Fallon SJ, Davies DM, Trull TW (2009) Multi-century time-series of ^{15}N and ^{14}C in bamboo corals from deep Tasmanian seamounts: Evidence for stable oceanographic conditions. *Marine Ecology Progress Series* 397: 209-218.
11. Risk MJ, **Sherwood OA**, Nairn R, Gibbons C (2009) Tracking the record of sewage discharge off Jeddah, Saudi Arabia, since 1950, using stable isotope records from antipatharians. *Marine Ecology Progress Series* 397: 219-226.
10. Risk MJ, Lapointe BE, **Sherwood OA**, Bedford B (2009). The use of $\delta^{15}\text{N}$ in assessing sewage stress on coral reefs. *Marine Pollution Bulletin* 58: 793-802 (MPB Best Paper of 2009 Award).
9. **Sherwood OA**, Edinger EN. (2009) Ages and growth rates of some cold-water gorgonian and antipatharian corals of Newfoundland and Labrador. *Canadian Journal of Fisheries and Aquatic Sciences* 66: 142-152.
8. **Sherwood OA**, Guilderson TP, Edinger EN, Ghaleb B, Risk MJ, Scott DB. (2008) Late Holocene radiocarbon variability in Northwest Atlantic slope waters. *Earth and Planetary Science Letters* 275: 146-153.
7. **Sherwood OA**, Jamieson R, Edinger EN, Wareham VE. (2008) Stable C and N isotopic composition of cold-water corals from the Newfoundland and Labrador continental slope: examination of trophic, depth and spatial effects. *Deep-Sea Research Part I* 55: 1392-1402.
6. **Sherwood OA**, Scott DB, Risk MJ (2006) Late Holocene radiocarbon and aspartic acid racemization dating of deep-sea octocorals. *Geochimica et Cosmochimica Acta* 70: 2806-2814.
5. **Sherwood OA**, Heikoop JM, Scott DB, Risk MJ, Guilderson TP, McKinney RA (2005) Stable isotopic composition of deep sea gorgonian corals (*Primnoa* spp.): a new archive of surface processes. *Marine Ecology Progress Series* 301: 135-148.

4. **Sherwood OA**, Scott DB, Risk MJ, Guilderson TP (2005) Radiocarbon evidence for annual growth rings in the deep sea octocoral *Primnoa resedaeformis*. *Marine Ecology Progress Series* 301: 129-134.
3. Ward-Paige CA, Risk MJ, **Sherwood OA** (2005) Clionid sponge surveys on the Florida reef tract suggest land-based nutrient inputs. *Marine Pollution Bulletin* 51: 570-579.
2. Ward-Paige CA, Risk MJ, **Sherwood OA** (2005) Reconstruction of nitrogen sources on coral reefs: $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ in gorgonians from Florida Reef Tract. *Marine Ecology Progress Series*. 296: 155-163.
1. Risk MJ, **Sherwood OA**, Heikoop JM, Llewellyn G (2003) Smoke signals from corals: isotopic signature of the 1997 Indonesian 'haze' event. *Marine Geology* 202: 71-78.

Book Chapters

4. **Sherwood OA**, Travers PD, Dolan MP (2014). Compound-specific stable isotopic analysis of natural and produced hydrocarbons surrounding oil and gas operations. In: Ferrer I, Thurman EM (Eds.) *Advanced Techniques in Gas Chromatography-Mass Spectrometry (GC-MS-MS and GC-TOF-MS) for Environmental Chemistry*. Elsevier, pp. 347-372.
3. **Sherwood OA**, Risk MJ (2007). Deep-sea corals: New insights to paleoceanography. In: Hillaire-Marcel C, de Vernal A (Eds.) *Proxies in Late Cenozoic Paleoceanography*. Elsevier, pp. 491-517.
2. **Sherwood OA**, Heikoop JM, Sinclair DJ, Scott DB, Risk MJ, Shearer C, Azetsu-Scott K (2005) Skeletal Mg/Ca in *Primnoa resedaeformis*: relationship to temperature? In: Freiwald A, Roberts JM (Eds.) *Cold-Water Corals and Ecosystems*. Springer, pp. 1061-1079.
1. Sinclair DJ, **Sherwood OA**, Risk MJ, Hillaire-Marcel C, Tubrett M, Sylvester P, McCulloch M, Kinsley L (2005) Testing the reproducibility of Mg/Ca profiles in the deep-water coral *Primnoa resedaeformis*: putting the proxy through its paces. In: Freiwald A, Roberts JM (Eds.) *Cold-Water Corals and Ecosystems*. Springer, pp. 1039-1060.

Government Reports

2. Prouty NG, Roark EB, Andrews A, Robinson LF, Hill T, **Sherwood OA**, Williams B, Guilderson TP, Fallon SJ. Age and growth rates and paleoclimate studies. In: Etnoyer PJ, Cairns SD, Hourigan T (Eds.) *State of Deep-Sea Coral and Sponge Ecosystems of the United States: 2014*. NOAA (in press).
1. Gilkinson K, Edinger E (Eds) *The Ecology of Deep-Sea Corals of Newfoundland and Labrador Waters: Biogeography, Life History, Biogeochemistry, and Relation to Fishes*. Can Tech Rep of Fish and Aquatic Sci No. 2830. pp 66-73. (Two chapters as primary author and one as co-author)

Extended Abstracts

4. Armstrong KJ, Rogers JD, Burke TL, Ryan JN, **Sherwood OA** (2017) Characterization of accidental spills and releases affecting groundwater in the Greater Wattenberg area of the

Denver-Julesburg basin in northeastern Colorado. SPE Health, Safety, Security Environment & Social Responsibility Conference – North America. SPE paper no. SPE-184435-MS.

3. Strauss J, Schaiberger A, Rosenau N, Travers P, **Sherwood OA**, Dolan MP (2014) Using stable isotopes and water quality to investigate sources of stray gas in the Wattenberg Field of Colorado. Unconventional Resources Technology Conference, Denver, USA. URTEC paper no. 1922468.
2. **Sherwood OA**, Travers P, Dolan MP (2013) Hydrocarbon maturity and migration analysis using production gas stable isotopic signatures in the Wattenberg Field, Denver Basin, Colorado, USA. Unconventional Resources Technology Conference, Denver, USA. URTEC paper no. 1580285.
1. **Sherwood OA**, Thresher RE, Fallon SJ, Davies DM, Trull TW (2008) Deep-sea bamboo corals from the Tasmanian seamounts: Isotopic evidence for benthic-pelagic coupling. ICES Annual Science Conference, Halifax, Canada. CM 2008/C:18.

Recent Conference Presentations and Posters

12. **Sherwood OA**, McMahon K, Guilderson TP, McCarthy MD (2014) Late Holocene plankton domain shifts in the North Pacific subtropical gyre revealed by amino acid specific $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ records from proteinaceous deep-sea corals. AGU Fall Meeting, San Francisco, USA. (invited speaker)
11. Schwietzke S, **Sherwood OA**, Tans P, Michel SE, Miller JB, Dlugokencky EJ, Griffin W, Bruhwiler L (2014) Long-term trends and confidence in global natural gas fugitive emissions rates based in $\delta^{13}\text{C}\text{-CH}_4$. AGU Fall Meeting, San Francisco, USA.
10. Vaughn BH, Rella C, **Sherwood OA**, Petron G (2014) Ground based mobile isotopic methane measurements in the Front Range, Colorado. AGU Fall Meeting, San Francisco, USA.
9. Rogers JN, **Sherwood OA**, Lackey G, Burke T, Osborn S, Ryan JN (2014) Occurrence and origin of methane in relation to major ion concentrations in groundwater wells of the Denver-Julesburg and Piceance basins of Colorado. AGU Fall Meeting, San Francisco, USA.
8. Michel SE, Miller JB, Dlugokencky EJ, Vaughn BH, White JC, Sack AL, **Sherwood OA**, Masarie KA (2014). As methane concentration goes up, stable isotopes of methane go down: ^{13}C implicates a microbial source across latitudinal gradients. AGU Fall Meeting, San Francisco, USA.
7. **Sherwood OA**, Rogers JD, Lackey GD, Burke TL, Osborn SG, Ryan JN (2014) Identification and occurrence of thermogenic stray gas in groundwater wells of the Denver-Julesburg and Piceance basins of Colorado. GSA Annual Meeting, Vancouver, Canada.
6. **Sherwood OA**, Batista FC, Brown JT, Guilderson TP, McCarthy MD (2012) Thousand year archives of bulk and compound-specific $\delta^{15}\text{N}$ of export production from the North Pacific Subtropical Gyre indicate increasing nitrogen fixation over the past 150 Years. AGU Fall Meeting, San Francisco, USA.
5. Brown JT, Batista FC, **Sherwood OA**, Ravelo AC, Hill T, Guilderson TP, McCarthy MD (2012) Compound-specific $\delta^{13}\text{C}$ of amino acids in a deep-sea coral (*Isidella*) from the Monterey Canyon. AGU Fall Meeting, San Francisco, USA.

4. McCarthy MD, Batista FC, Vokhshoori NL, Brown JT, Guilderson TP, Ravelo AC, **Sherwood OA** (2012) Phenylalanine $\delta^{15}\text{N}$ in paleo archives as a new proxy for $\delta^{15}\text{N}$ of exported primary production. AGU Fall Meeting, San Francisco, USA.
3. **Sherwood OA**, Batista FC, Guilderson TP, McCarthy MD (2012) Amino acid-specific nitrogen isotopic composition of deep-sea corals: unraveling paleo-nitrogen cycle interactions. ASLO/AGU Ocean Sciences Meeting, Salt Lake City, USA.
2. McCarthy MD, **Sherwood OA**, Batista F, Lehmann M, Ravelo C, Schubert C (2011) Nitrogen isotopes of amino acids: First results in sediments and gorgonian corals of a new tool to reconstruct organic nitrogen source and cycling from paleoarchives. 25th International Meeting on Organic Geochemistry, Bremen, Germany.
1. Edinger EN, **Sherwood OA** (2011) Taphonomy of gorgonian and antipatharian cold-water corals in Atlantic Canada: experimental decay rates and field observations. 6th International Meeting on Taphonomy and Fossilization, Tübingen, Germany.

Published Databases

1. **Sherwood OA**, Guilderson TP, Batista FC, Schiff JT, McCarthy MD. Hawaiian gold coral bulk and compound specific nitrogen isotope data for the last millennium. NOAA Paleoclimate Data Center, <http://www.ncdc.noaa.gov/paleo/study/17435>.

Collaborators

- Kumiko Azetsu-Scott, Department of Fisheries and Oceans, Halifax, Canada
- Evan Edinger, Memorial University of Newfoundland, St John's, Canada
- Stewart Fallon, Australian National University, Canberra, Australia
- Kent Gilkinson, Department of Fisheries and Oceans, St. John's, Canada
- Tom Guilderson, Lawrence Livermore National Laboratory, Livermore, USA
- Jeffrey Heikoop, Los Alamos National Laboratory, Los Alamos, USA
- Liam Herringshaw, Durham University, Durham, United Kingdom
- Tessa Hill, University of California, Davis, USA
- Claude Hillaire-Marcel, GEOTOP, Montreal, Canada
- Brian Lapointe, Harbor Branch Oceanographic Institute, Fort Pierce, USA
- Moritz Lehman, Universität Basel, Basel, Switzerland
- Matthew McCarthy, University of California, Santa Cruz, USA
- Duncan McIlroy, Memorial University, St. John's, Canada
- Kelton McMahan, University of California, Santa Cruz, USA
- Gabrielle Petron, NOAA, Boulder, USA
- David Piper, Geological Survey of Canada, Halifax, Canada
- Mike Risk, McMaster University, Hamilton, Canada
- Joe Ryan, University of Colorado, Boulder, USA
- Carsten Schubert, Eawag, Dübendorf, Switzerland
- Stefan Schwietzke, NOAA, Boulder, USA
- David Scott, Dalhousie University, Halifax, Canada
- Dan Sinclair, Victoria University of Wellington, Wellington, New Zealand

- Ron Thresher, CSIRO Marine and Atmospheric Sciences, Hobart, Australia
- Tom Trull, University of Tasmania, Hobart, Australia
- Bruce Vaughn, INSTAAR, University of Colorado, Boulder, USA
- James White, INSTAAR, University of Colorado, Boulder, USA
- Mark Williams, INSTAAR, University of Colorado, Boulder, USA

Seagoing Experience

- 2016: CCGS *Amundsen*. ROV geological/biological survey, Baffin Bay (2 weeks).
- 2007: CCGS *Hudson*. ROV geological/biological survey, Scotian Slope and Grand Banks (3 weeks).
- 2006: CCGS *Teleost* multi-species biological survey, Orphan Basin (2 weeks).
- 2003: CCGS *Hudson* physical oceanographic survey, Flemish Pass (1 week).

Professional Development

- 2011: Interpretation Geophysics School, ExxonMobil, Houston (2 weeks).
- 2010: Fundamentals of Stratigraphic and Structural Concepts Field School, ExxonMobil, West Texas, New Mexico and Utah (2 weeks).
- 2010: Fundamentals of Subsurface Interpretation, ExxonMobil, Houston (2 weeks).
- 2010: Assessment Concepts, Imperial Oil, Calgary (1 week).
- 2010: Rocky Mountain Geology Field Trip, Imperial Oil, Calgary (3 days).
- 2009: Geological Operations and Formation Evaluation, ExxonMobil, Houston (3 weeks).

Service and Outreach

- Reviewer for: *Bulletin of Marine Science, Canadian Journal of Fisheries and Aquatic Sciences, Coral Reefs, Deep-Sea Research, Earth and Planetary Science Letters, Fisheries Research, Geochimica et Cosmochimica Acta, Global Biogeochemical Cycles, Hydrobiologia, Hydrogeology Journal, Limnology & Oceanography, Marine Biology, Marine Ecology, Marine Ecology Progress Series, Marine and Freshwater Research, Marine Pollution Bulletin, Nature Geoscience, Organic Geochemistry, Paleoceanography, P-cubed, PLoS ONE, Quaternary Science Reviews, Rapid Communications in Mass Spectrometry, Water Air & Soil Pollution, Water Resources Research*
- Reviewer for: National Science Foundation, NOAA Undersea Research Program, Hong Kong Research Grants Council.
- Session chair, GSA Annual meeting, Vancouver, 2014.
- Science Fair Volunteer Judge, Boulder area elementary schools, 2013-present.
- Lunch-and-Learn Coordinator, Imperial Oil, 2010.
- Recruiting Committee, Imperial Oil, 2010.
- Session chair, ASLO summer meeting, St. John's, 2008.

- Graduate society executive, Dalhousie University Earth Sciences Department, 2003-2005.

Other Relevant Experience/Certification

- GC-IRMS lab design, instrumentation, calibration and method development.
- Numerical and statistical modeling/programming in Matlab, R, and SAS.
- Experience with a wide range analytical geochemical techniques, including: GC-IRMS, GC-MS, LC-MS, ICP-MS, TIMS, SIMS, AMS, XRF, EM.
- Seismic interpretation and mapping in Geoframe and Petrel.
- Core logging, well correlation, stratigraphic analysis.
- Prospect generation, deterministic and probabilistic hydrocarbon play assessment.

References

- Dr. Matthew McCarthy. Ocean Sciences Department, UC Santa Cruz, Santa Cruz, CA, USA. Tel: (831) 459-4718. Email: mccarthy@pmc.ucsc.edu
- Dr. Tom Guilderson. Lawrence Livermore National Laboratory, Livermore, CA, USA. Tel: 925-422-1753. Email: tguilderson@llnl.gov
- Dr. Evan Edinger. Departments of Geography, Biology and Earth Sciences, Memorial University of Newfoundland, St. John's, NL, Canada. Tel: (709) 737-3233. Email: eedinger@cs.mun.ca
- Dr. Joe Ryan. Dept. of Civil, Environmental, and Architectural Engineering, University of Colorado, Boulder, CO, USA. Tel: (303)492-0772. Email: joseph.ryan@colorado.edu
- Mr. Bruce Vaughn. INSTAAR, University of Colorado, Boulder, CO, USA. Tel: (303) 492-7985. Email: bruce.vaughn@colorado.edu (Unavailable April 22 - June 10, 2015)