

Daniel M. Sigman – Curriculum Vitae

Dusenbury Professor of Geological and Geophysical Sciences, Department of Geosciences, Guyot Hall, Princeton University, Princeton, NJ 08544, tel: (609)-258-2194, e-mail: sigman@princeton.edu

Education

B.S., 1991, Stanford University, Geology, with Distinction

Ph.D., 1997, MIT/WHOI Joint Program in Oceanography
Thesis title: “The Role of Biological Production in Pleistocene Atmospheric Carbon Dioxide Variations and the Nitrogen Isotope Dynamics of the Southern Ocean”

Professional Experience

Assistant Professor of Geosciences, Princeton University (2000-2006)
Dusenbury Preceptor, Princeton University (2004-2006)
Professor of Geosciences, Princeton University (2006-2009)
Dusenbury Professor of Geological and Geophysical Sciences, Princeton University (2009-)

Fellowships

Woods Hole Oceanographic Institution, Summer Student Fellow (1990)
National Science Foundation, Graduate Fellow (1991-1994)
Joint Oceanographic Institutions, Schlanger Ocean Drilling Program Fellow (1995-1997)
Dept. of Geosciences, Princeton University, Harry Hess Postdoctoral Fellow (1998-1999)

Honors

Phi Beta Kappa (1991)
Macelwane Medal of the American Geophysical Union (2004)
Friedrich Wilhelm Bessel Award of the Alexander von Humboldt Foundation (2004)
National Science Foundation CAREER Award (2005)
Blavatnik Finalist, New York Academy of Science (2009)
MacArthur Fellowship (2009)

Courses taught

GEO 102: Climate: Past, Present, and Future (w/ M. Bender)
FRS 1XX The Ocean Environment
GEO 318/ENV 318 Observing the Marine Environment (summer course taught at Bermuda Institute of Ocean Sciences with BIOS scientist M. Lomas)
GEO 322/ENV 322 Biogeochemical Cycles and Global Change
GEO 364 Earth Chemistry: Major Realms of the Planet (w/ M. Bender)
GEO 535 Biogeochemical Cycles and Earth History
GEO 700 Reading Course: Stable Isotope Geochemistry
GEO 700 Reading Course: Global Geochemical Modelling

Former Ph.D. students

Collaborated with Karen Casciotti, advisee of Bess Ward, “Molecular and Stable Isotopic Characterization of Enzymes Involved in Nitrification and Nitrifier-Denitrification”, November, 2002
Currently: Assistant Professor, Stanford University

Collaborated with Curtis Deutsch, advisee of Jorge Sarmiento, “Biogeochemical constraints on the modern and glacial oceanic nitrogen cycle”, November, 2003
Currently: Assistant Professor, UCLA

Meredith Galanter Hastings, “Studies of reactive nitrogen in the atmosphere using global modeling and stable isotope measurements”, May, 2004
Currently: postdoctoral fellow, University of Washington, Department of Atmospheric Sciences; from September, 2007: Assistant Professor, Brown University

Collaborated with Ben Houlton, advisee of Lars Hedin (Ecology and Evolutionary Biology), “Isotopic evidence for the climate-dependence of nitrogen cycles across old tropical rainforests, Mt. Haleakala, Hawaii”, April, 2005
Currently: Assistant Professor, UC Davis

Angela Noel Knapp, “The Stable Isotopic Composition of Dissolved Organic Nitrogen and Nitrate in the Subtropical Ocean”, January, 2006
Currently: Research Assistant Professor, University of Miami, RSMAS

External advisor for Julie Granger, advisee of Philippe Tortell, University of British Columbia, “Coupled nitrogen and oxygen isotope fractionation of nitrate imparted during its assimilation and dissimilatory reduction by unicellular plankton,” August, 2006
Currently: Assistant Professor, University of Connecticut

Brigitte Brunelle, “Nitrogen isotope constraints on the biogeochemistry and paleoclimatology of the Subarctic North Pacific,” September, 2009
Currently: Project Scientist, Basic and Applied Research Office, National Geospatial-Intelligence Agency

Peter DiFiore, “Nitrate Isotope Dynamics in the Southern Ocean,” April, 2010
Currently: Analyst, Risk Management Solutions

Haojia Ren, “Development and Paleooceanographic Application of Planktonic Foraminifera-Bound Nitrogen Isotopes,” October, 2010
Currently: UCAR Global Change Postdoctoral Fellow, Columbia University

Former postdoctoral investigators

Rebecca Robinson Graham (9/01 – 8/05)
Ph.D. from University of Michigan, Dept. of Geological Sciences
Currently: Assistant Professor, University of Rhode Island, School of Oceanography

Moritz Lehmann (5/02 – 5/04)
Ph.D. from ETH Zurich, Dept. of Earth Sciences
Currently: Associate Professor, University of Basel, Institute for Environmental Geoscience

Agatha de Boer (5/03 – 12/05; co-advised by Robbie Toggweiler of GFDL)

Ph.D. from University of Southern Florida, Dept. of Oceanography
Currently: Associate Professor, Stockholm University

Maria Prokopenko (1/05 – 8/07)
Ph.D. from University of Southern California, Dept. of Earth Sciences
Currently: Research Scientist, University of Southern California

Julie Granger (5/07 – 8/11)
Ph.D. from University of British Columbia, Department of Earth and Ocean Science
Currently: Assistant Professor, University of Connecticut

Kritee K. (7/08 – 9/10)
Ph.D. from Rutgers University, Institute of Marine and Coastal Sciences
Currently: High Meadows Scientist, Environmental Defense Fund

Department activities (current-2000)

Chair, Geosciences faculty searches: paleoclimate, 2010; Atmospheric and Oceanic Sciences, 2008

Chair, Undergraduate work committee: Fall, 2010, while G. Keller was on sabbatical; with Adam Maloof, developed new Geosciences undergraduate curriculum (implemented in Fall, 2009); all years, Geosciences freshman/sophomore advisor

Co-wrote a successful NSF Major Research Instrumentation proposal for isotope ratio instrumentation for biogeosciences research at Princeton (co-PI: Bess Ward), which includes substantial instrumentation for departmental and university use, 2009

University activities (current-2000)

Member, Faculty Board, Princeton Energy and Climate Scholars (PECS) program (Fall, 2008 – 2010)

Member, University Research Board, 2006 – 2008

Princeton-Bermuda Institute of Ocean Sciences, Undergraduate Summer Internship Program, co-organizer (with Dr. Gerry Plumley, BBSR), 2005 - 2006

Princeton Freshman Scholars Institute, instructor for summer laboratory, 2005

Graduate generals exam committee member (Geosciences, Civil Engineering, Ecology and Evolutionary Biology)

Princeton Environmental Institute associated faculty member, 2000 – current

Outside activities (current-2000)

Canadian Institute for Advanced Research (CIFAR), February (Vancouver) and November (Toronto), 2008, invited participant in “oceans” workshop(s) to consider a

new CIFAR virtual research center; talks: “The use of stable isotopes to study the nitrogen cycle”, “What can the past ocean tell us about the future ocean and its nitrogen cycle?”

Co-chair of Leverhulme Climate Meeting on “Using the paleoclimate record to inform us regarding future climate change,” London, UK, 2008

Member, Scientific Steering Committee, US Geotraces (the US component of an international initiative to undertake coordinated research into the distribution of trace elements and isotopes in the ocean), 6/2006 – 6/2009

Associate Editor, *Paleoceanography*, 2004-2009

Instructor, “Geobiology 2003: An international training course in a rapidly evolving field,” Catalina Island, California, July 2003

Lecturer, Grand Combin Summer School, Course XI, “Paleoclimate: Combining Observations and Dynamics,” Etroubles, Italy, June 2003

Thesis defense committee for Katsumi Matsumoto, LDEO, Columbia University, June 2000

Secretary, Paleoceanography/Paleoclimatology Working Group, Ocean Carbon Transport, Exchanges, and Transformations (NSF-sponsored workshop), March 2000

Member, SCOPE (the Scientific Committee on Problems of the Environment of the International Council of Scientific Unions) working group on assessing oceanic nitrogen fixation, 1999-2001

Reviewer: American Journal of Science, Deep Sea Research, Earth and Planetary Science Letters, Geophysical Research Letters, Geochimica et Cosmochimica Acta, Geology, Paleoceanography, Global Biogeochemical Cycles, Marine Chemistry, Nature, Journal of Geophysical Research, Journal of Oceanography, Continental Shelf Research, Limnology and Oceanography, Paleogeography, Paleoclimatology, Paleoecology, Quaternary Science Reviews, Reviews of Geophysics, Science, Soil Science Society of America Journal

Proposal reviewer: US NSF, US NOAA, UK NRC, Swiss NSF, Canadian NERC, EUSF, German Leibnitz Foundation, Australian Antarctic Division

Research grants (current – 2000)

NSF DIMENSIONS Program, “Dimensions: Collaborative Research: Functional Diversity of Marine Eukaryotic Phytoplankton and Their Contributions to C and N Cycling,” 1/12-12/14, \$1.4M, co-PI’s: B. Ward (Princeton, lead), A. Allen (JVCI), GEO

NSF Chemical Oceanography Program, 3/11-2/14, \$620k, “Understanding the nitrogen isotopes of foraminifera: A modern Sargasso Sea study,” GEO

NSF Atmospheric Chemistry Program, 1/11-12/14, \$390k, “Collaborative Research: Isotopic and Compositional Investigation of the Sources and Interactions of Reactive N in the Marine Atmosphere at Bermuda,” co-PI’s: M. Hastings (Brown, lead PI) and A. Peters (BIOS), GEO

NSF Chemical Oceanography Program, 5/10-4/12, \$270k, “Collaborative Research: GEOTRACES Atlantic Section Nitrate Isotope Measurements,” co-PI’s: Karen Casciotti (WHOI) and Meredith Hastings (Brown)

NSF Major Research Instrumentation, 9/09-8/11, \$516k, “MRI: Acquisition of Stable Isotope Instrumentation for the Biogeosciences at Princeton University,” with Bess Ward

NSF Chemical Oceanography, 9/07-8/10, \$109k
“Collaborative Research: Non-local bacterial transport of nitrate within sediments underlying oxygen deficient zones: A new twist in the N cycle,” with Will Berelson and Masha Prokopenko of USC

Camille and Henry Dreyfus Foundation, Postdoctoral Program in Environmental Chemistry, 7/08-6/10, \$120k, “The ocean nitrogen imbalance paradox and the denitrification isotope effect”

NSF Bering Ecosystem Study Program, 9/06-8/10, \$466k
“BEST: Nitrogen Supply for New Production and its Relation to Climatic Conditions on the Eastern Bering Sea Shelf”

NSF CAREER Award Program, 9/05-8/10, \$731k
“CAREER: Nitrate Isotopes and Biogeochemistry: A Plan for coupling graduate and undergraduate education”

NSF Polar Programs, 5/05-4/08, \$350k **ended**
“Application of a new method for isotopic analysis of diatom microfossil-bound nitrogen”

NASA/IDS, 9/04-8/08, \$105k **ended**
“Natural iron fertilization in the ocean and its impacts on ocean nitrogen fixation and carbon cycles”
lead PI’s: Yuan Gao (Montclair State) and Paul Falkowski (Rutgers)
other co-PI’s: Yoram Kaufman (NASA), Mick Follows (MIT), Daniel Sigman (Princeton)

NSF Chemical Oceanography, 1/02-12/04, \$191k **ended**
"Collaborative Research: Isotopic constraints on the nitrogen dynamics of the Bering Sea" co-PI: Daniel C. McCorkle, Woods Hole Oceanographic Institution

NSF Biocomplexity, 1/00-12/04, \$135k **ended**
“Collaborative Research: Ocean N₂ fixation and global climate”

co-PI's: Anthony Michaels, Doug Capone, Gerald Haug, A. Subramaniam, USC; Dave Karl, UH; Ed Boyle, MIT; Scott Doney, UCAR; Dave Siegel, Nathalie Mahowald, UCSB; Sergio Sanudo-Wilhelmy, SUNY

NSF Marine Geology (Earth Systems History), 6/00-5/03, \$406k ****ended****
“Changes in glacial circulation and biogeochemistry associated with changing Southern Ocean Winds”; co-PI: Anand Gnanadesikan, now at GFDL

Invited presentations (current – 2000)

ACS National Meeting, Denver, CO, August, 2011, Session: Nitrogen and the Human Endeavor, Talk title: “Sluggish ocean nitrogen budget during the last ice age”

Chemical Oceanography Gordon Conference, Andover, NH, August, 2011, “The ocean's nitrogen isotope budget, today and during the last ice age”

Woods Hole Oceanographic Institution Geology and Geophysics Seminar, Woods Hole, MA, March, 2011, “Why the amplitude of glacial/interglacial carbon dioxide change appears to require more than one Southern Ocean change”

International Conference of Paleoceanography X, La Jolla, California, September 2010, Keynote: “The ocean’s carbonate pump reduces the atmospheric carbon dioxide drawdown of the Antarctic ‘ventilation barrier’ mechanisms”

2010 Aspen Environment Forum, Aspen, Colorado, July, 2010
Discussant in the session “Acid Oceans: Global Warming’s Evil Twin”

Penn State University, Department of Geosciences Colloquium, April, 2010: “The Southern Ocean hypothesis for lower ice age carbon dioxide: An analysis of its geochemical components”

Agouron Institute Nitrogen Meeting, Scottsdale, Arizona, September, 2009: “A sluggish ocean N budget during the last ice age”

Goldschmidt 2009 Annual Meeting, Davos, Switzerland, June, 2009, keynote: “Polar twins: The Antarctic and North Pacific during ice ages”

Caltech Geochemistry Seminar, April 2009: “Foraminifera-bound nitrogen isotopes and the ice age ocean's slower nitrogen budget”

American Geophysical Union Fall Meeting, December, 2008, special session: “Past changes in atmospheric CO₂: Roles of the biological pump and the ocean carbonate system”, talk title: “The polar ocean and glacial cycles in atmospheric carbon dioxide: Approaching the sawtooth”

MIT/WHOI Joint Program 40th Anniversary Celebration, invited speaker representing Marine Geology and Geophysics, MIT, Cambridge, MA, September, 2008:

“Foraminifera-bound nitrogen isotopes and the rate of Atlantic nitrogen fixation during the last ice age”

Woods Hole Oceanographic Institution, Marine Chemistry and Geochemistry Weekly Seminar, September, 2008: “Nitrogen fixation in the Atlantic, today and during the last ice age”

Rutgers University, Earth and Planetary Sciences Seminar, September, 2009: “The isotopes of nitrogen in foraminifera shells and glacial/interglacial changes in the ocean's nitrogen budget”

UCLA, Institute of Geophysics and Planetary Physics weekly colloquium, April, 2008: “Glacial/interglacial carbon dioxide change and the polar ocean”

UCSD, Scripps Institution of Oceanography, Earth Seminar, March, 2008: "The polar ocean, glacial cycles, and atmospheric CO₂"

Leverhulme Climate Meeting, Cambridge, UK, March 2008, “Using the paleoclimate record to inform us regarding future climate change,” invited plenary speaker for Theme 4, “Carbon cycle”

American Geophysical Union Fall Meeting, December, 2007, special session: “From cells to cycles: The impacts of microbially mediated redox reactions on modern and paleo biogeochemical cycles”, talk title: “Culture studies of N and O isotope coupling in nitrate assimilation and denitrification”

Harvard University Climate Seminar, November, 2007: “The polar ocean, glacial cycles, and atmospheric CO₂”

MIT Program in Atmospheres, Oceans, and Climate retreat, Waterville Valley, NH, October, 2007: “Sargasso Sea nitrate isotopes, general circulation model experiments, and Atlantic N₂ fixation”

GEOTRACES Data-Model Synergy Workshop, Delmenhorst, Germany, September, 2007: “Sargasso Sea nitrate isotopes, general circulation model experiments, and Atlantic N₂ fixation”

Gordon Conference in Polar Marine Science, Ventura, CA, March, 2007: “Ice Ages, the halocline-bearing polar ocean regions, and atmospheric CO₂”

Brown University, Wayland Collegium Faculty Seminar, November, 2006: (1) “The coupled N and O isotopes of nitrate in the ocean”, (2) “Polar ocean stratification during the last ice age: New data, physical mechanisms, and a deglacial hypothesis”

UCLA, Institute of Geophysics and Planetary Physics weekly colloquium, June, 2006: “The nutrient status of the polar ocean during the last ice age”

Duke Marine Laboratory Seminar Series, February, 2006: “The N and O isotopes of nitrate in the ocean”

Zentrum für Marine und Atmosphärische Wissenschaften, Hamburg, weekly seminar, November, 2005: “The N and O isotopes of nitrate in the ocean”

International meeting on the ocean nitrogen cycle: “Significant Processes, Observations, and Transformations in Oceanic Nitrogen”, Warnemünde, Germany, June, 2005: “Coupled measurement of the nitrogen and oxygen isotopes of nitrate in the ocean”

Lamont-Doherty Earth Observatory Geochemistry Seminar, June, 2005: “Polar ocean stratification and nutrient status during the last Ice Age”

Lamont-Doherty Earth Observatory and the Department of Earth and Environmental Science at Columbia University Colloquium, January, 2005: “Coupled measurement of the nitrogen and oxygen isotopes of nitrate in the ocean: Basic systematics and an application in the eastern North Pacific”

American Geophysical Union 2004 Fall Meeting, special session: “Cariaco Basin: Modern and Ancient Processes”, December 2004: “The nitrogen isotope dynamics of the modern Cariaco Basin”

California Institute of Technology, Division of Geological and Planetary Sciences Colloquium, November 2004: “The nitrogen and oxygen isotopes of nitrate in the ocean”

International Conference of Paleoceanography VIII, Biarritz, France, September 2004: “Nitrate utilization in the Southern Ocean during the last Ice Age: Evidence from a new method for diatom microfossil-bound nitrogen isotopic analysis”

Ecological Society of America Annual Meeting, August 2004, special symposium: “Frontiers in the Biogeosciences: Ecology and the Earth Sciences”: “The isotopic composition of dissolved organic nitrogen and nitrate at the Bermuda Atlantic Time-series Study”

GEOTRACES (meeting for an initiative to study trace species in the ocean), Lamont Doherty Earth Observatory of Columbia University, May, 2004 plenary: “Constraints on Subantarctic biogeochemistry from nitrate isotopes”

Massachusetts Institute of Technology, Earth, Atmospheric and Planetary Sciences Colloquium, April 2004: “The isotopic composition of diatom-bound N and the nutrient status of the polar ocean during the last ice age”

Harvard University, Department of Earth and Planetary Sciences Colloquium, April, 2003: “Evidence for a link between global cooling and polar ocean stratification over the last three million years”

ASLO Annual Meeting, 2003, Salt Lake City, UT (February, 2003), Session: “Nitrogen Paleo-Biogeochemistry”, invited ‘tutorial’: “Glacial/interglacial variations in the oceanic nitrogen cycle: An overview”

University of Hawaii, Department of Geology and Geophysics Weekly Seminar, October 2002: “Cold climates, polar ocean stratification, and atmospheric carbon dioxide”

Gordon Conference on Chemical Oceanography, (New Hampshire, August 2001): “The coupled measurement of nitrogen and oxygen isotopes in oceanic nitrate: A new tool for the study of the marine nitrogen cycle”

American Geophysical Union Fall Meeting, Special session: “Redox processes in oxygen deficient regions of the ocean”, December 2000: “Coupled nitrogen and oxygen isotopic measurements of nitrate in the water column of the Eastern Tropical North Pacific”

Twelfth Annual Frontiers of Science Symposium, National Academy of Sciences, November, 2000, invited participant with poster: “Using stable isotopes to study the history of the nitrogen cycle”

Goldschmidt 2000, an International Conference for Geochemistry, Oxford, UK, Symposium: "Ocean Circulation: Past and Present", August, 2000, invited keynote speaker: “The nutrient status of the Southern Ocean during the last ice age and its links to the global ocean”

NOAA/CORC Workshop, Lamont-Doherty Earth Observatory, June, 2000, invited speaker: “The $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ of water column nitrate in the northeast Pacific: Dual constraints on the N cycle”

Cornell University, Biogeochemistry Seminar, May 2000, invited speaker: “Ice ages and the biogeochemistry of the Southern Ocean”

American Chemical Society 219th National Meeting, Special Session: “Metals, Metaloenzymes, and Global Change”, March 2000, San Francisco, invited speaker: “Global carbon cycle and its links to carbon fixation by oceanic phytoplankton”

American Geophysical Union Ocean Sciences Meeting, February, 2000, San Antonio, invited speaker: “Status of the Southern Ocean hypothesis for glacial-interglacial carbon dioxide changes”

Outreach

Presentations at children’s annual elementary school science fair and in-class visits (topics: ocean fossils; ocean circulation; rock cycle)

Interactive presentations about the history of Earth and life
Presented to: Chapin School, Princeton, NJ, April 2002; Princeton Undergraduate Preparatory Program, Princeton University, August 2002, 2003