

Ariel D. Anbar

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President's Professor
School of Earth & Space Exploration
and School of Molecular Sciences
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Biographical Summary

Ariel Anbar is a scientist and educator interested in Earth's past and future as an inhabited world, and the prospects for life beyond. His group develops novel geochemical methods to study topics ranging from the chemical evolution of the atmosphere and oceans to human disease. Trained as a geologist and a chemist, Anbar is a President's Professor at Arizona State University on the faculty of the School of Earth & Space Exploration and the School of Molecular Sciences, and a Distinguished Sustainability Scholar in ASU's Global Institute of Sustainability. Anbar directed ASU's Astrobiology Program from 2009 – 2015 and directs the Center for Education Through Exploration. A graduate of Harvard and Caltech, he was on the faculty of the University of Rochester before moving to ASU in 2004. An author of >180 refereed papers, Anbar is a Fellow of the American Geophysical Union, the Geological Society of America, the Geochemical Society and the European Association of Geochemistry, and is a Howard Hughes Medical Institute Professor. He is a recipient of the Donath Medal and the Arthur L. Day Medal of the Geological Society of America.

Education

1996 Ph.D. (Geochemistry) California Institute of Technology, Pasadena, CA
1991 M.S. (Geochemistry) California Institute of Technology, Pasadena, CA
1989 A.B. (Geological Sciences and Chemistry) Harvard College, Cambridge, MA

Mentors

Graduate: G. J. Wasserburg & Y. L. Yung; Undergraduate: H. D. Holland

Professional Experience

2013 – present President's Professor
2009 – 2013 Professor
2004 – 2009 Associate Professor
School of Earth & Space Exploration (pre-2006, Dept. of Geological Sciences)
School of Molecular Sciences (pre-2015, Dept. of Chemistry & Biochemistry)
Arizona State University

2018 – present Affiliated Faculty, Mary Lou Fulton Teachers College
2015 – present Director, ASU Center for Education Through eXploration
2015 – present Co-Director, ASU PlanetWorks Initiative
2009 – 2016 Director, ASU Astrobiology Program
2010 – 2011 Associate Director, ASU Origins Project
2014 – present Distinguished Sustainability Scientist, ASU Global Institute of Sustainability
2010 – 2014 Senior Sustainability Scientist, ASU Global Institute of Sustainability

2002 – 2004 Associate Professor
1996 – 2002 Assistant Professor
Dept. of Earth & Environmental Sciences and Dept. of Chemistry
University of Rochester

Career Achievement Summary

- >180 peer-reviewed papers (> 23 first author; > 65 led by student or postdoc supervisees)
- 19,286 citations; 30 papers with > 200 citations; h-index 70 (*Google Scholar*)
- 22 publications in *Science* or *Nature* journals (incl. 2 letter-to-editor & 2 reply-to-comment)
- > 400 conference abstracts
- > 165 invited presentations/colloquia at universities
- > 45 invited conference presentations (e.g., AGU, GSA, Goldschmidt)
- 16 invited book chapters, reports, reviews, white papers
- 6 invited oral presentations at Gordon Research Conferences
- PI of ~ \$30 million in cumulative awards
- Major grant awards include:
 - PI of NASA Exploration Connection project: \$10.2M, 2016 – 2021; \$10.8M, 2021 – 2026
 - PI of NSF Frontiers in Earth System Dynamics “Early O₂” Team: \$5M, 2013 – 2019
 - PI of NASA Astrobiology Institute Team “Follow the Elements”: \$6.5M, 2009 – 2015
- Primary supervisor of 16 Ph.D. students, 10 M.S. students, 3 in progress
- Primary supervisor of 16 postdocs
- Significant service includes:
 - President-Elect, President, Past-President, AGU Biogeosciences Section, 2015 – 2020
 - Director, ASU Center for Education Through eXploration, 2015 – present
 - Co-Chair, 2010 Gordon Research Conference on Environmental Bioinorganic Chemistry
 - Chair, Science Steering Committee, 2008 Astrobiology Science Conference
 - Co-Chair, NASA Astrobiology Inst. Deep Time Drilling Project, 2002 – 2008
- Notable recognition includes:
 - Arthur L. Day Medal, Geological Society of America, 2020
 - Science Innovation Award, European Association of Geochemistry, 2019
 - ASU Alumni Association Founders Day Teaching Achievement Award, 2018
 - Named one of 10 “teaching innovators”, Chronicle of Higher Education, 2017
 - Fellow, Geochemical Society and European Association of Geochemistry, 2015
 - Howard Hughes Medical Institute Professor, 2014
 - Fellow, Geological Society of America, 2003
 - Donath Medal (Young Scientist Award), Geological Society of America, 2002

Post-Ph.D. Research Supervisees (cumulative, alphabetical)

- Dr. Gail Arnold, Ph.D. 2004, U. Rochester; ASU Research Scientist, '05 – '07
Present Position: Director, Medical Professions Institute, University of Texas – El Paso
- Dr. Jane Barling, Ph.D. 1990, Monash University; UR Research Scientist, '98 – '02
Present Position: Senior Research Fellow, University of Oxford
- Dr. Melanie Channon, Ph.D. 2012, Caltech; ASU Bisgrove Postdoctoral Fellow, '12 – '15
Present Position: Independent Artist
- Dr. Geoff Gilleaudeau, Ph.D. 2014, U. Tennessee; NRC Postdoct. Fellow (ASU), '16 – '18
Present Position: Assistant Professor, George Mason University
- Dr. Gwyneth Gordon, Ph.D. 2002, Yale University; ASU Research Scientist '03 – '18
Present Position: Laboratory Manager, ASU (Assistant Research Prof. appointment pending)
- Dr. Amy Kelly, Ph.D. 2009, MIT; ASU Postdoctoral Fellow, '11 – '12
Present Position: Supply Chain Lead, Shell Oil Company

- Dr. Brian Kendall, Ph.D. 2008, U. Alberta; Agouron Postdoctoral Fellow (ASU), '08 – '12
Present Position: Associate Professor, University of Waterloo
- Dr. Brian Majestic, Ph.D. 2007, U. Wisc.; Dreyfus Env. Sci. Fellow (ASU), '07 – '09
Present Position: Associate Professor, University of Denver
- Dr. Amisha Poret-Peterson, Ph.D. 2009, U. Louisville; ASU Research Scientist, '12 – '15
Present Position: Research Microbiologist, USDA-ARS
- Dr. Steven Romaniello, Ph.D. 2012, ASU; ASU Research Scientist, '14 – '19
Present Position: Associate Professor, University of Tennessee - Knoxville
- Dr. Moutusi Roy, Ph.D. 2011, Oregon State U.; ASU Research Scientist, '12 – '15
Present Position: Research Staff, Boston Analytical
- Dr. Christopher Siebert, Ph.D. 2002, U. Bern; ASU Postdoctoral Fellow, '05 – '06
Present Position: Research Scientist, GEOMAR
- Dr. Laura Wasylenki, Ph.D. 1998, Caltech; ASU Research Scientist, '04 – '10
Present Position: Associate Professor, Northern Arizona University
- Dr. Felisa Wolfe-Simon, Ph.D. 2006, Rutgers; ASU Postdoctoral Fellow, '06 – '07
Present Position: Chan-Norris Visiting Professor, Mills College
- Dr. Gregory Wortman, Ph.D. 1998, Syracuse University; UR Research Associate, '99 – '01
Present Position: Senior Scientist, Honeywell UOP
- Dr. Wang Zheng, Ph.D. 2010, Trent University; ASU Research Specialist, '15 – '18
Present Position: Assistant Professor, Tianjin University

ETX Center Staff Supervisees (cumulative – note that most ETX Center staff report through a managerial hierarchy overseen by Elizabeth McHugh and Joseph Tamer)

- Mr. Christopher Andert, User Experience Designer
- Mr. David Armijo, Multimedia Designer
- Ms. Mia Bodin, Learning Designer
- Mr. Don Bratton, Manager of Learning Design
- Mr. Geoffrey Bruce, Exploration Architect
- Ms. Katrina Fogelson, Associate Learning Designer
- Ms. Chelsea Goldsmith, Project Manager
- Dr. Lev Horodyskyj, Learning Design Architect
- Ms. Diana Hunsley, Manager of University Projects
- Ms. Sina Kirk, Community Coordinator
- Ms. Alice Letcher, Project Manager
- Mr. Leon Manfredi, Learning Designer
- Ms. Elizabeth McHugh, Administrative Director and Chief Culture Officer
- Dr. Christopher Mead, Research Manager
- Ms. Melanie Narish, Learning Designer
- Mr. Michael Potter, Developer
- Ms. Melissa Renfrey, Project Manager
- Ms. Siobhan Sackey, Learning Designer
- Mr. Josef Shindler, Game Design Lead
- Ms. Jessica Swann, Community Manager
- Mr. Joseph Tamer, Program Manager & Asst. Director
- Ms. Wendy Taylor, Curriculum Developer
- Ms. Bianca Zietal, Associate Instructional Designer

Awards & Honors

Individual

Fellow, American Geophysical Union, 2021
Arthur L. Day Medal, Geological Society of America, 2020
Science Innovation Award, European Association of Geochemistry, 2019
ASU Alumni Association Founders Day Teaching Achievement Award, 2018
Distinguished Miller Lecturer in Geography, Pennsylvania State University, 2018
Named one of 10 “teaching innovators”, Chronicle of Higher Education, 2017
Endowed Biogeochemistry Lecture at Goldschmidt Conference, Geochemical Society, 2017
Fellow, Geochemical Society and European Association of Geochemistry, elected 2015
Gary Krahenbuhl Difference Maker Award, Arizona State University, 2015
Howard Hughes Medical Institute Professor, 2014
President’s Professor, Arizona State University, 2013
Award for Excellence (education/academic), Academy of Interactive & Visual Arts, 2013
Selected “Most Influential Professor” by a graduating athlete, Arizona State University, 2013
Visiting Professor, Hebrew University, Jerusalem, Israel, Spring 2012
Last Lecture Series Award, Arizona State University, 2006
Fellow, Geological Society of America, elected 2003
Young Scientist Award (Donath Medal), Geological Society of America, 2002
Cindy Arveson Memorial Award, California Institute of Technology, 1993
NSF Graduate Research Fellowship, California Institute of Technology, 1989 – 1992
Homestake Mining and Economic Geology Award, Harvard University, 1988
Harvard College Scholarship, 1986 - 1989
National Merit Scholarship, 1985

As Mentor

NASA FINESST Fellowship, Dan Sullivan (ASU), 2020 - 2023
ASU First Year Fellowship, Pilar Vergeli (ASU), 2018 - 2019
NSF Graduate Research Fellowship, Logan Tegler (ASU/MIT-WHOI), 2018 - 2021
NESSF Fellowship, Aleisha Johnson (ASU), 2017 - 2020
NSF Graduate Research Fellowship, Chad Ostrander (ASU), 2016 - 2019
Outstanding Student Poster Award, AGU, Marc Neveu (ASU), 2013
NSF Graduate Research Fellowship, Bryan Rolfe (ASU/Cornell), 2011
Nininger Meteorite Award, Greg Brennecka (ASU), 2010
GSA Outstanding Student Research Award, Greg Brennecka (ASU), 2010
P.E.O. International Scholar Award, Jennifer Glass (ASU), 2010
Student Poster 1st Prize, SoCA Geobiology Symposium, Jennifer Glass (ASU), 2010
Student Poster 2nd Prize, AbSciCon, Jennifer Glass (ASU), 2010
Brian Mason Award of the Meteoritical Society, Greg Brennecka (ASU), 2009
Goldwater Scholarship, Bryan Rolfe (ASU), 2008
Outstanding Student Talk, SoCal Geobiology Symp. Jennifer Glass (ASU), 2007
NSF Graduate Research Fellowship, Jennifer Glass (ASU), 2007 - 2010
Student Poster 1st Prize, AbSciCon, Gail Arnold (UR), 2004
Outstanding Student Poster Award, AGU, Matt Polizzotto (UR), 2000
Goldwater Scholarship, Matt Polizzotto (UR), 2000

Major Professional Service

NASA and Related

Member, Planetary Science Subcommittee of the NASA Advisory Council, 2014 – 2017
2017 Astrobiology Science Conference, Science Organizing Committee, 2016 – 2017
Lead organizer, Upstairs-Downstairs Workshop Without Walls, NAI-NExSS-NSF, 2016
SETI Institute Scientific Advisory Board, 2014 – 2016
NASA ASTEP Program Review Panel member, 2016
Exobiology Program Review Panel Chief, 2014
Astrobiology Roadmap Workshop, 2014
Deputy PI, Life Investigations for Enceladus (LIFE) mission concept, 2012 – 2015
Member of Science Team, Enceladus Life Finder (ELF), 2014 – present
Member, NASA Astrobiology Institute Executive Council, 2009 – 2014
Member, Supporting Research & Technology SAG, MEPAG, 2010
Member, Mars Mid-Rover SAG, MEPAG, 2009
Member, Science & Technology Committee of the Human Space Flight Review Team, 2009
Chair, Science Steering Committee, Astrobiology Science Conference, 2007 – 2008
Member, Joint Science Definition Team, Europa Jupiter System Mission, 2008 – 2010
Member, Science Organizing Committee, Pale Blue Dot III, 2006
Member, Science Organizing Committee, AbSciCon, 2006
Member, Science Organizing Committee, NAC Lunar Exploration Science Workshop, 2006
Member, Planetary Science Subcommittee of the NASA Advisory Council, 2006 – 2008
Invited Oral Testimony to President's Commission on Moon, Mars and Beyond, 2004
Member, Mars-Moon Science Steering Group, NASA, 2004
Member, Lunar Exploration Analysis Group (LEAG), NASA, 2005 - present
Co-Chair, Mission to Early Earth Focus Group, NASA Astrobiology Institute, 2001 – 2007
Co-Chair, Deep Time Drilling Project, 2002 – 2008
Member of Steering Committee, Astrobiology Drilling Program, 2003 – 2013
Panelist, NASA Early Career Workshop, LPSC Meeting, '04

Other Extramural

HHMI Society of Professors Executive Board, 2018 – present
Past-President, Biogeosciences Section of the American Geophysical Union, 2019 – 2020
President, Biogeosciences Section of the American Geophysical Union, 2017 – 2019
President-Elect, Biogeosciences Section of the American Geophysical Union, 2015 – 2017
Chair, Search Committee for GeoHealth journal, American Geophysical Union, 2016 – 2017
Co-Organizer, Union panel at AGU Fall Meeting, *Planetary Intelligence: Managing Earth's Future*, 2016
Invited Oral Testimony to NAS panel on STEM undergraduate research experiences, 2016
Co-Editor, *Chemical Geology Special Issue dedicated to H.D. Holland*, 2012 – 2013
Specialty Chief Co-Editor, *Frontiers in Microbiological Chemistry*, 2010 – 2017
Advisory Board, *Metallomics* (RSC), 2010 – present
Editorial Board, *Geochemical Perspectives Letters* (EAG), 2017 – present
Editorial Board, *Chemical Geology* (Elsevier), 2006 – 2016
Editorial Board, *Metallomics* (RSC), 2008 – 2010
Editorial Board, *Geology* (GSA), 2003 – 2005; 2006 – 2008
Editorial Advisory Board, *Geobiology* (Blackwell Publishing), 2003 – 2008
Elected Councillor, Int'l Society for the Study of the Origin of Life; ISSOL, 2008 - 2011

Co-Chair, Gordon Conference on Environmental Bioinorganic Chemistry, 2008 – 2010
International Program Committee, Goldschmidt '05, '06
Co-Convener: ~ 25 special sessions at AGU, GSA and Goldschmidt meetings
Invited Participant to various workshops including: Life Detection (NAS, 2000); Geobiology (Amer. Acad. Microbio., 2000); Paleoproxies (NSF, 2005); Biosignatures (NRC, 2006); Oxygen (Agouron, 2006); Deep Drilling (Agouron, 2006); Nitrogen (Agouron, 2009); Geobiology (NSF, 2010); Astrobiology Roadmap (2014)
Reviewer of publications for GCA, EPSL, Chem. Geol., Anal. Chem., Science, Nature
Reviewer of proposals for NSF and NASA

ASU – SESE/GLG

Director, Center for Education Through eXploration, 2015 – present
Chair, SESE Colloquium Committee, 2019 – present
Chair, Ad hoc Space Planning Committee, 2019 – present
Promotion and Tenure Committee, 2008 – 2009 (sabbatical substitute); 2012 – 2014
Ad Hoc Bateman Space Allocation Committee, Chair, 2011 – 2013
Search Committee for Isotope Geochemistry Faculty, 2012 - 2013
Heptennial Review Committee, 2010 – 2011
Graduate Committee, 2005 – 2008 (Chair of Oversight Subcommittee, 2007-2008)
Faculty Search Advisory Committee, 2006
GLG/SESE Honors Disciplinary Advisor, 2005 – present
Search Committee for SESE Director, 2005 – 2006
Faculty Safety Officer, 2004 – 2005
Structure/Governance Subcommittee (during SESE conceptualization process), 2004
Active participant of various ad hoc committees for faculty searches and curriculum redesign

ASU – Department of Chemistry & Biochemistry

Awards Committee, 2019 – present
Undergraduate Program Committee, 2016 – 2017
Committee on Interdepartmental Relations, 2014 – 2015
Committee on School Formation, 2014 – 2015
Committee on Online Course Materials and Development, 2014 – 2015
Personnel and Budget Committee, 2008 – 2009; 2012 – 2015
Strategic Planning – Chemistry of Global Sustainability – Committee, 2008
Strategic Planning Committee, 2007
Awards Committee, 2007 – 2008
Search Committee for Bioinorganic Faculty, 2005
Septennial Review Committee, 2005
Seminar Committee, 2004 – 2005

ASU – Other

Member, KED Chemical and Environmental Core Facility Board, 2017 – 2020
ASU Team Leadership Academy (PlanetWorks Team), 2016 – 2018
Co-Lead, ASU PlanetWorks Initiative, 2015 – present
Co-Lead Organizer, Planetary Design: Climate 3.0 Workshop, 2016
President's Academic Council, 2014 – present
Advisory Board, Institute for the Science of Teaching and Learning, 2014 – 2015
Chair, Provost's Working Group on General Education, 2013 – 2014
Panelist, Funding Success Skills Series, OKED ASU, 2014

Member, General Studies Council, 2013 – 2016
Arizona Science Education Consortium Executive Committee, 2012 – 2015
ReSETS Committee, CLAS and Mary Lou Fulton Teacher's College, 2011 – 2012
Provost's Committee on Excellence in Digital Learning and Teaching, 2011 - 2013
Biodesign Graduate Program Committee, 2012 – present
Director, ASU Astrobiology Program, 2009 – 2015
Origins Project Faculty Advisory Committee, 2009 – 2012
Origins Symposium Program Committee, 2008 – 2009
Provisional Steering Committee, Environmental Life Science Graduate Program, 2008
Curriculum Development, School of Sustainability (no formal committee), 2006 – 2008
Keck Laboratory Executive Committee, 2004 – present
ASU Provost's Teaching Awards Committee, 2007
Organizer, Biogeochemistry Interest Group (w/Hilairy Hartnett), 2005 – 2006

U. Rochester

V.P. Campus Affairs, Hillel of Rochester Area Colleges, 2001 – 2002
Faculty Advisor, Sigma Epsilon Fraternity, 2001 – 2004
Freshman Housing Implementation Committee, 2000 – 2002
Residential College Commission, 1997 – 1999
Faculty-in-Residence, 1996 – 1999
Panelist for NSF and NASA funding programs

Significant Public Outreach & Media Coverage

Are We Alone? – Valley Beit Midrash lecture, December 2020

<https://youtu.be/GvW8Pyq7VHI>

Habitable Planets Beyond Earth with Ariel Anbar – ASU Learn with Me playlist, September 2020

<https://youtu.be/1hyoK9ygezK>

ASU pilot class creates immersive 'virtual field trips' as teaching tool, January 2019

https://www.azfamily.com/news/asu-pilot-class-creates-immersive-virtual-field-trips-as-teaching/article_15ba817c-211c-11e9-b8f2-ebf3a5975058.html

Stable Isotopes Offer Novel Methods of Disease Detection. Earth Magazine, January 2018

<https://www.earthmagazine.org/article/stable-isotopes-offer-novel-methods-disease-detection>

Chronicle of Higher Education special report on “10 Classroom Trailblazers”, October 2017

<http://www.chronicle.com/specialreport/Innovators-10-Classroom/156>

Designing Earth's Future – ASU KEDtalk, September 2017

<https://research.asu.edu/stories/asu-kedtalk-designing-earths-future>

Inside Higher Ed report on the Infiniscope project, “Reaching for the Stars”, April 2017

<https://www.insidehighered.com/digital-learning/article/2017/04/12/asu-uses-nasa-data-create-middle-and-high-school-program>

Scientists Discover the Heavens are Hell. BloombergView, March 2017

<https://www.bloomberg.com/view/articles/2017-03-06/scientists-discover-the-heavens-are-hell>

Educating Through Exploration – TEDxASU presentation, March 2017

<https://www.youtube.com/watch?v=g5Ait70JOqI>

HabWorlds featured in *A National Education Call to Action*. Inside Higher Ed, January 2017

<https://www.insidehighered.com/blogs/higher-ed-gamma/national-educational-technology-call-action>

HabWorlds highlighted in *Reimagining the Role of Technology in Higher Education*, Office of Educational Technology, U.S. Dept. of Education, January 2017

<https://tech.ed.gov/files/2017/01/Higher-Ed-NETP.pdf>

KJZZ (PBS) Interview with Mark Brodie: Getting scientists on the same page, December 2016

<http://theshow.kjzz.org/content/405009/trying-get-scientists-different-disciplines-same-page>

Digital Learning's Pioneers are Cautiously Optimistic. EdSurge, July 2016

<https://www.edsurge.com/news/2016-07-10-digital-learning-s-pioneers-are-cautiously-optimistic>

The Great Oxidation Event - Evolving understandings of how oxygenic life on Earth began. BioScience, February, 2016

<http://bioscience.oxfordjournals.org/lookup/doi/10.1093/biosci/biv193>

'Academic crowdsourcing' allows lecturers to share ideas. Times Higher Education, 2016

<https://www.timeshighereducation.com/news/academic-crowdsourcing-allows-lecturers-share-ideas>

Is Pluto a Planet? Who Cares! Op-ed in Slate, 2015

http://www.slate.com/articles/technology/future_tense/2015/07/new_horizons_what_pluto_tells_us_about_scientific_literacy.html

e-Literate TV feature about *Habitable Worlds*, 2015

<https://e-literate-tv.inthetelling.com/#/episode/553fe28241f6dfb4e4003566/>

Phoenix Magazine – Movers & Shakers, 2015

<http://www.phoenixmag.com/people/2015-movers-shakers-ariel-anbar.html>

Chronicle of Higher Education feature on STEM education, 2015

<http://chronicle.com/article/Teaching-Science-So-It-Sticks/229881/?key=HGt3JwVkJHIOZSxkZTdfNDcBb3JsYkwmZiAYOH11blFXGA==>

Forbes coverage of Enceladus mission concepts, 2015

<http://www.forbes.com/sites/brucedorminey/2015/04/29/nasa-may-plumb-for-signs-of-life-in-enceladus-plume/>

Scientific American coverage of Habitable Worlds, 2015

<http://blogs.scientificamerican.com/observations/2015/01/21/habitable-worlds-course/>

Campus Technology coverage of Inspark Science Network, 2015
<http://campustechnology.com/articles/2015/01/20/college-network-transforming-science-gains-momentum.aspx>

Inside Higher Ed coverage of Habitable Worlds, 2014
<https://www.insidehighered.com/news/2014/10/10/emerging-adaptive-software-puts-faculty-members-charge-course-creation>

Higher Ed Live webcast: Thought Leaders in Ed Tech: The Inspark Science Network, 2014
<http://www.higheredlive.com/thought-leaders-in-ed-tech-the-inspark-science-network/>

NSF Discoveries feature on HHMI-supported immersive virtual field trips, 2014
http://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=132758

Organizer and panelist for ASU National and Global Issues Forum: Space Exploration: How and Why? November, 2013, National Press Club
<http://forum.asu.edu/forum/space-exploration>
<http://sese.asu.edu/news/success-new-space-era-hinges-publics-interest>

Emerge 2013 Workshop Lead: Is the Truth Out There? Hunting for Habitable Worlds.
<http://emerge2013.asu.edu/workshops/is-the-truth-out-there-hunting-for-habitable-worlds/>

eLiterate feature story, 2013
<http://mfeldstein.com/the-openclass-vision-an-example/>

Forbes coverage of Dynamics of Earth System Oxygenation project, 2013
<http://www.forbes.com/sites/brucedorminey/2013/08/31/oxygens-ancient-rise-still-one-of-earths-biggest-mysteries/>

TED Ed Video, A Needle in Countless Haystacks: Finding Habitable Worlds, 2012
<http://ed.ted.com/lessons/a-needle-in-countless-haystacks-finding-habitable-planets-ariel-anbar>

American Institute of Physics video production on Ca isotopes and bone, 2012
 Filmed in 2012; in production

Channel 8 (PBS), *ASU Discovers: Science of Detection*, 2012
http://www.youtube.com/watch?v=V6cLr40_4Rw

Chemical Heritage Foundation Podcast: Bones, 2012
<http://www.chemheritage.org/discover/media/distillations/164-bones.aspx>

SIFT Podcast: Define Life, 2012
<http://siftpodcast.com/define-life/>

Channel 12 (NBC), *12 News: 2012: End of the World?* (w/Michael Smith), 2011
<http://www.azcentral.com/video/#/2012%3A+End+of+the+world%3F/1339820820001>

Channel 8 (PBS), *Horizons: Ocean Chemistry Research* (w/Greg Brennecka), 2011
<http://www.azpbs.org/arizonahorizon/detail.php?id=1748#OceanChemistryResearch>

Scottsdale Museum of Contemporary Art: science presentation for “90 Days over 100”, 2010
<http://phxated.com/scott-andrews/90-days-over-100-at-smoca-closing-event/>

KJZZ (PBS), *Interview with Dennis Lambert: Uncovering Earth’s Oxygenation*, 2010
http://archive.kjzz.org/news/arizona/archives/201010/ME_OceanOxygen

Channel 8 (PBS), *Horizons: New Life on Earth* (w/Paul Davies), 2010
<http://www.azpbs.org/arizonahorizon/detail.php?id=1516#NewLifeonEarth>

Channel 8 (PBS), *Minds over Matters: pilot* (w/Phil Christensen), 2009
<http://www.azpbs.org/video/play.php?vidId=1521>

Science Friday: Astrobiology & the Origin of Life (with panel), 2009
<http://www.sciencefriday.com/program/archives/200904032>

Publications and Presentations

* = Anbar-mentored student first author

= Anbar-mentored postdoc or staff first author

¶ = Anbar-mentored visiting student or scientist first author

*Total Refereed Publications in Print or Press (self-counted): 184**Total Citations (Google Scholar): 19,286 (9688 since 2016)**h-index (Google Scholar): 70 (58 since 2016)**i10-index (Google Scholar): 161 (138 since 2016)***Refereed Publications in Print or Press:**

1. M. L. Cable, C. Porco, C. R. Glein, C. R. German, S. M. MacKenzie, M. Neveu, T. M. Hoehler, A. E. Hofmann, A. R. Hendrix, J. Eigenbrode, F. Postberg, L. J. Spilker, A. McEwen, N. Khawaja, J. H. Waite, P. Wurz, J. Helbert, A. Anbar, J-P. de Vera, and J. Núñez (2021). The Science Case for a Return to Enceladus. *The Planetary Science Journal*, **2**: 132.
2. *X. Chen, S. Romaniello, and A. D. Anbar (2021). Preliminary exploration of molybdenum isotope fractionation during coprecipitation of molybdate with abiotic and microbial calcite. *Chemical Geology* **566**: 120102. (<https://doi.org/10.1016/j.chemgeo.2021.120102>)
3. *X. Chen, S. J. Romaniello, M. McCormick, A. Sherry, J. R. Havig, W. Zheng, and A. D. Anbar (2021). Anoxic depositional overprinting of 238U/235U in calcite: When do carbonates tell black shale tales? *Geology* (<https://doi.org/10.1130/G48949.1>)
4. S. Desch, A. Jackson, J. Noviello, and A. Anbar (2021). The Chicxulub impactor: comet or asteroid? *Astronomy & Geophysics* **62**: 3-34.
5. A. G. Dunlea, L. A. Tegler, B. Peucker-Ehrenbrink, A. D. Anbar, S. J. Romaniello, and T. J. Horner (2021). Pelagic clays as archives of marine iron isotope chemistry. *Chemical Geology*, **575**:120201
6. #G. J. Gilleaudeau, T. J. Algeo, T. W. Lyons, S. Bates, and A. D. Anbar (2021). Novel watermass reconstruction in the Early Mississippian Appalachian Seaway based on integrated proxy records of redox and salinity. *Earth and Planetary Science Letters* **558**: 116746.
7. ¶K. T. Goto, Y. Sekine, T. Ito, K. Suzuki, A. D. Anbar, G. W. Gordon, Y. Harigane, T. Maruoka, G. Shimoda, T. Kashiwabara, and Y. Takaya (2021). Progressive ocean oxygenation at ~2.2 Ga inferred from geochemistry and molybdenum isotopes of the Nsuta Mn deposit, Ghana. *Chemical Geology* **567**: 120116. (<https://doi.org/10.1016/j.chemgeo.2021.120116>)
8. A. T. Greaney, R. L. Rudnick, S. J. Romaniello, A. C. Johnson, A. D. Anbar, and M. L. Cummings (2021). Assessing molybdenum isotope fractionation during continental weathering as recorded by weathering profiles in saprolites and bauxites. *Chemical Geology* **566**: 120103. (<https://doi.org/10.1016/j.chemgeo.2021.120103>)

9. B. Kaçar, A. K. Garcia, and A. D. Anbar (2021). Evolutionary history of bioessential elements can guide the search for life in the Universe. *ChemBioChem* **22**: 114-119. (<https://doi.org/10.1002/cbic.202000500>)
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Invited Chapters, Reports, Reviews, White Papers, Etc. (not refereed):

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4. C. Mead, A. D. Anbar, L. B. Horodyskyj, and D. Bratton (2020). “Education Through Exploration: A model for using adaptive learning to teach laboratory science online”. In: *Astronomy Education Volume 1: Online Formal and Informal Learning*, C. Impey and M. Wenger, eds. IOP Publishing.
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Patents and Invention Disclosures:

1. T. Steimle, A. D. Anbar, and J. L. Skulan. *System and Method for Isotopic Analysis of Calcium Using Laser Induced Fluorescence*. U.S. Patent No. 10,302,565, issued 5/28/2019.
2. A. D. Anbar, J. L. Skulan, G. Gordon, and J. Morgan. *Isotopic Biomarkers for Rapid Assessment of Bone Mineral Balance in Biomedical Applications*. U.S. Patent No. 9,261,519, issued 2/16/2016.

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2. A. D. Anbar, C. M. Ostrander, A. Johnson and D. C. Catling (2020). Redox Revolutions on Earth and Beyond: Implications for Life Detection on Extrasolar Worlds. Abstract P024-0008 presented at the 2020 Fall Meeting, AGU, Online, 1-17 Dec.
3. D. Bratton, A. D. Anbar, M. Renfrey, J. L. Swann, C. Mead, M. Bodin (2020). Using an Interactive, 3D Visualization to Teach Phases of the Moon. Abstract ED012-04 presented at the 2020 Fall Meeting, AGU, Online, 1-17 Dec.
4. G. Bruce, C. Mead, W. Taylor and A. D. Anbar (2020). Gamifying virtual exploration of the past 350 million years of vertebrate evolution. Abstract ED006-11 presented at the 2020 Fall Meeting, AGU, Online, 1-17 Dec.
5. S. Kadoya, D. C. Catling, R. W. Nicklas, I. S. Puchtel and A. D. Anbar (2020). Secular oxidation of the mantle decreased the proportion of reducing gases in volcanic emissions and could trigger the atmospheric oxygenation. Abstract DI022-06 presented at the 2020 Fall Meeting, AGU, Online, 1-17 Dec.
6. *C. M. Ostrander, T. W. Lyons, B. Kendall, S. Severmann, S. J. Romaniello, W. Zheng and A. D. Anbar (2020). New Fe isotope insights into the oxidation history of a Neoproterozoic Earth. Abstract V032-0005 presented at the 2020 Fall Meeting, AGU, Online, 1-17 Dec.
7. *T. J. Ruberto, C. Mead, R. Aggarwal, G. Bruce, S. Semken, A. J. Tamer and A. D. Anbar (2020). Democratizing Virtual Field Trips: Teaching Learners to Create Their Own Virtual Field Trips for Earth and Space Science and Sustainability. Abstract ED006-10 presented at the 2020 Fall Meeting, AGU, Online, 1-17 Dec.
8. J. Swann, S. Kirk, C. Mead and A. D. Anbar (2020). Teacher Professional Development to Support Transition to Online. Abstract ED013-06 presented at the 2020 Fall Meeting, AGU, Online, 1-17 Dec.
9. *P. Vergeli, S. J. Romaniello, H. E. Hartnett, W. Zheng and A. D. Anbar (2020). Assessing the Importance of Iron Photo-oxidation on Ancient Earth and Beyond. Abstract EP059-03 presented at the 2020 Fall Meeting, AGU, Online, 1-17 Dec.
10. A. D. Anbar (2020). Redox Revolutions: Earth and Beyond. Abstract U11-02 presented at the 2020 JpGU-AGU Joint Meeting, Online, 12-16 July.

11. S. Kadoya, D. C. Catling, R. W. Nicklas, I. S. Puchtel and A. D. Anbar (2020). Mantle data imply that secular oxidation can drive oxygenation of the atmosphere. Abstract BCG06-05 presented at the 2020 JpGU-AGU Joint Meeting, Online, 12-16 July. **Invited**.
12. A. D. Anbar (2020). Applications of Non-Traditional Isotopes to Environmental and Human Health – A 2040 Perspective. Goldschmidt 2020, <https://doi.org/10.46427/gold2020.58>
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18. A. D. Anbar and H. E. Hartnett (2019). Biogeosciences beyond: Inventing a science of living worlds. Abstract B14B-01 presented at the 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec. **Invited**.
19. H. E. Hartnett, N. R. Hinkel, A. D. Anbar, S. J. Desch, T. Fisher, H. Furukawa, D. Glaser, J. G. Okie, C. T. Unterborn, P. Vergeli, S. Walker, and P. Young (2019). The biogeosciences are a critical step on the path toward detecting life on exoplanets. Abstract B13C-11 presented at the 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.
20. #J. L. Swann, C. Mead, and A. D. Anbar (2019). Consumers to creators: Reducing the barrier of entry for educators to customize digital learning experiences. Abstract ED11B-0863 presented at the 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.
21. #D. Bratton, M. Renfrey, K. Fogelson, C. Mead, and A. D. Anbar (2019). Combining Eyes on the Solar System, a rich narrative, and adaptive feedback to teach Solar and Lunar eclipses. Abstract ED11B-0871 presented at the 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.
22. #C. Mead and A. D. Anbar (2019). Using computer learning analytics to support learning design, evaluation, and teaching. Abstract ED12A-02 presented at the 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.

23. #G. Bruce, W. Taylor, C. Mead, S. Buxner, S. Semken, and A. D. Anbar (2019). Gamifying Virtual Exploration of the Past 350 Million Years of Vertebrate Evolution. Abstract ED22A-01 presented at the 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.
24. #A. J. Tamer, T. Ruberto, C. Mead, G. Bruce, S. Semken, A. D. Anbar, and R. Aggarwal (2019). Teaching and learning about Earth science and sustainability with student-created virtual field trips. Abstract ED22A-06 presented at the 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.
25. #C. Mead, S. Brownell, J. P. Collins, P. LePore, and A. D. Anbar (2019). Using Institutional Analysis of Grades to Assess Equity of Outcomes in Online and In-Person Science Courses. Abstract ED31C-0977 presented at the 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.
26. *C. M. Ostrander, J. D. Owens, S. Nielson, and A. D. Anbar (2019). Tracking the accumulation of O₂ in Archean oceans using thallium and molybdenum isotopes. Abstract V23B-01 presented at the 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec.
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35. *A. C. Johnson, S. J. Romaniello, C. M. Ostrander, C. T. Reinhard, T. W. Lyons, and A. D. Anbar (2019). Assessing the bioavailability of Mo in Archean oceans. Geological Society of America Abstracts with Programs. Vol. 51, No. 5, doi: 10.1130/abs/2019AM-341070
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37. A. D. Anbar (2019). The Mission to Early Earth: The 20-year Legacy of NASA's First Astrobiology Sample Return. Astrobiology Science Conference, Seattle, WA, June 24 – 28. **Invited.**
38. *C. M. Ostrander, S. Nielsen, J. D. Owends, B. Kendall, G. W. Gordon, S. J. Romaniello, and A. D. Anbar (2019). Fully oxygenated water columns over continental shelves before the Great Oxidation Event. Astrobiology Science Conference, Seattle, WA, June 24 – 28. **Invited.**
39. #L. Horodyski, C. Mead, C. Oliver, and A. D. Anbar (2018). Teaching Real Science: A Novel Approach to Teaching Students the Scientific Process. Astrobiology Science Conference, Seattle, WA, June 24 – 28.
40. *D. L. Sullivan, S. J. Romaniello, and A. D. Anbar (2019). Developing Rhenium Isotopes as a Paleoredox Proxy. Goldschmidt2019 18-23 August, Barcelona, Spain.
41. A. D. Anbar (2019). Isotope Paleoredox Proxies: From Inspiration to Innovation – Samuel Epstein Science Innovation Award Lecture. Goldschmidt2019 18-23 August, Barcelona, Spain. **Invited.**
42. A. D. Anbar (2019). The Planet as Province. Goldschmidt2019 18-23 August, Barcelona, Spain. **Invited.**
43. *C. Ostrander and A. D. Anbar (2019). New Insights after a Good Long Sniff of the “Whiff”. Goldschmidt2019 18-23 August, Barcelona, Spain.
44. #S. J. Romaniello, G. W. Gordon, J. Skulan, S. M. Smith, S. R. Zwart, and A. D. Anbar (2019). Evaluating Spaceflight-Induced Bone Loss in Astronauts Using Ca Isotopes. Goldschmidt2019 18-23 August, Barcelona, Spain.

45. *A. Johnson, S. Aarons, N. Dauphas, N. Nie, H. Zeng, F. Teng, R. Helz, G. Galli, S. J. Romaniello, and A. D. Anbar (2019). Titanium Isotope Fractionation in Kilauea Iki Lava Lake is Driven by the Crystallization of Oxides. Goldschmidt2019 18-23 August, Barcelona, Spain.
46. *F. Zhang, S. Xiao, T. Dahl, N. Planavsky, S. J. Romaniello, T. Lenton, and A. D. Anbar (2019). Extensive Marine Anoxia during the Tonian Period Revealed by Uranium Isotopes in Marine Carbonates. Goldschmidt2019 18-23 August, Barcelona, Spain.
47. #G. Gilleaudeau, T. Algeo, T. Lyons, S. Bates, and A. D. Anbar (2019). Redox Gradients in the Early Mississippian Appalachian Basin: Evidence from Iron Speciation and Trace Metal Abundances. Goldschmidt2019 18-23 August, Barcelona, Spain.
48. A. D. Anbar (2019). Avoiding "false negatives" in the search for life on other worlds: Lessons from ancient Earth. ACS Annual Meeting and Expo, 28 March – 4 April, Orlando, Florida.
49. A. D. Anbar, L. Manfredi, D. Bratton, and A. J. Tamer (2018). Adapting 3D visualizations to meet the needs of educators in Earth and space sciences. Abstract ED32A-06 presented at the 2018 Fall Meeting, AGU, Washington, DC, 10-14 Dec.
50. *X. Chen, S. J. Romaniello, A. D. Herrmann, E. Samankassou, and A. D. Anbar (2018). Biological effects on uranium isotope fractionation in primary biogenic carbonates. Abstract PP44A-02 presented at the 2018 Fall Meeting, AGU, Washington, DC, 10-14 Dec.
51. #L. Horodyskyj, G. Bruce, S. Semken, A. D. Anbar, and L. Hosman (2018). Online geosciences offline. Abstract ED11C-0749 presented at the 2018 Fall Meeting, AGU, Washington, DC, 10-14 Dec.
52. #L. Horodyskyj, C. Mead, Z. Pardos, and A. D. Anbar (2018). Improving student outcomes through informed use of learning analytics. Abstract ED51G-0718 presented at the 2018 Fall Meeting, AGU, Washington, DC, 10-14 Dec.
53. *A. Hyatt, A. J. Tamer, W. M. Oliver, S. D. Spears, and A. D. Anbar (2018). Student-produced digital media to address misconceptions for multiple online audiences with an adaptive learning platform. Abstract ED41E-1236 presented at the 2018 Fall Meeting, AGU, Washington, DC, 10-14 Dec.
54. #C. Mead, H. B. Davis, J. L. Swann, and A. D. Anbar (2018). What kinds of digital learning experiences do educators want? Abstract ED31D-1084 presented at the 2018 Fall Meeting, AGU, Washington, DC, 10-14 Dec.
55. #C. Mead, A. Landrum, D. Kahan, and A. D. Anbar (2018). Science curiosity can predict success in science courses. Abstract ED41E-1250 presented at the 2018 Fall Meeting, AGU, Washington, DC, 10-14 Dec.
56. #S. J. Romaniello, A. Johnson, C. M. Ostrander, and A. D. Anbar (2018). How low can you Mo?: Reevaluating molybdenum limitation in Precambrian oceans. Abstract PP41D-1877 presented at the 2018 Fall Meeting, AGU, Washington, DC, 10-14 Dec.

57. #J. L. Swann, C. Mead, D. Hunsley, and A. D. Anbar (2018). Training educators to build and modify adaptive digital learning experiences. Abstract ED41E-1249 presented at the 2018 Fall Meeting, AGU, Washington, DC, 10-14 Dec.
58. N-T. Truong, C. R. Glein, A. Monroe, A. D. Anbar, and J. I. Lunine (2018). Decomposition of amino acids in water with application to Enceladus and other ocean worlds. Abstract P33A-08 presented at the 2018 Fall Meeting, AGU, Washington, DC, 10-14 Dec.
59. *A. C. Johnson, C. T. Reinhard, S. J. Romaniello, A. T. Greaney, D. D. Gregory, T. W. Lyons, and A. D. Anbar (2018). Constraints on Earth's stepwise oxygenation from sulfide oxidation experiments at low pO₂. 28th V. M. Goldschmidt Conference, 12-17 August, Boston, MA.
60. *F. Zhang, K. Lau, S. Romaniello, S. Xiao, and A. Anbar (2018). Calcium isotope constraints on the terminal Ediacaran rise of calcified animals. 28th V. M. Goldschmidt Conference, 12-17 August, Boston, MA.
61. Z. Li, F. Zhang, S. Romaniello, L. Zhao, and A. Anbar (2018). Climate change and U isotope excursion during Carnin Event in South China. 28th V. M. Goldschmidt Conference, 12-17 August, Boston, MA.
62. [†]A. T. Greaney, R. L. Rudnick, S. J. Romaniello, and A. D. Anbar (2018). Completing the molybdenum isotope mass balance in subduction zones. 28th V. M. Goldschmidt Conference, 12-17 August, Boston, MA.
63. #S. J. Romaniello, X. Chen, F. Zhang, T. J. Algeo, and A. D. Anbar (2018). Diagenesis is not a dirty word. 28th V. M. Goldschmidt Conference, 12-17 August, Boston, MA.
64. *X. Chen, S. Romaniello, M. McCormick, A. Sherry, J. Havig, and A. Anbar (2018). Do manganese oxides dominate transport of Mo across the chemocline of redox-stratified lakes? 28th V. M. Goldschmidt Conference, 12-17 August, Boston, MA.
65. H. Hartnett, C. Till, A. Anbar, D. Glaser, M. Guild, K. Iacovino, A. Johnson, J. Leong, and C. Ostrander (2018). Solid-Earth processes are key drivers in the evolution of Earth's redox state and set the stage for the Great Oxidation Event. 28th V. M. Goldschmidt Conference, 12-17 August, Boston, MA.
66. H. Zhao, F. Zhang, T. Algeo, S. Romaniello, and A. Anbar (2018). Uranium isotope variation across the Smithian-Spathian Boundary. 28th V. M. Goldschmidt Conference, 12-17 August, Boston, MA.
67. #W. Zheng, R. E. Summons, and A. D. Anbar (2018). Mercury isotopes as a novel proxy of photic zone euxinia. 28th V. M. Goldschmidt Conference, 12-17 August, Boston, MA.
68. *C. Ostrander, S. Nielsen, J. Owens, B. Kendall, G. Gordon, S. Romaniello, and A. Anbar (2018). Oxygen oases were persistent and widespread before the GOE. 28th V. M. Goldschmidt Conference, 12-17 August, Boston, MA.

69. A. D. Anbar (2018). Educating through exploration: emerging evidence for improved learning outcomes using a new theory of digital learning design. Abstract presented at the 231st Meeting of the American Astronomical Society, Washington, DC, 8-12 Jan. **Invited.**
70. A. D. Anbar, C. Mead, D. Bratton, L. Horodyskyj, J. Hayes, D. Schonstein, S. Watt, K. Watt, D. Ben-Naim, A. Leon (2017). Demonstrating the Value of Education Through Exploration as a Theory of Digital Design. Abstract ED41B-0275 presented at the 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
71. #G. J. Gilleaudeau, A. J. Kaufman, G. Luo, S. J. Romaniello, F. Zhang, L. Kah, K. Azmy, J. K. Bartley, S. K. Sahoo, A. H. Knoll, and A. D. Anbar (2017). Constraining the redox landscape of the mid-Proterozoic oceans: new insights from the carbonate uranium isotope record. Abstract PP43E-07 presented at the 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
72. †A. T. Greaney, R. L. Rudnick, S. J. Romaniello, A. Johnson, R. M. Gaschnig, and A. D. Anbar (2017). Molybdenum isotopes reveal oxidation of Earth's continental crust during the 2.4 Ga Great Oxidation Event. Abstract V24C-02 presented at the 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
73. #L. Horodyskyj, C. Mead, and A. D. Anbar (2017). Finding actionable data to support student success in introductory science courses. Abstract ED31E-01 presented at the 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec. **Invited.**
74. #L. Horodyskyj, T. Lennon, C. Mead, and A. D. Anbar (2017). Build a Catastrophe: Using Digital World and Policy Models to Engage Political Science Students with Climate Change. Abstract ED31A-0270 presented at the 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
75. J. R. McDaris, T. J. Bralower, A. D. Anbar, and A. Leinbach (2017). Teaching about the Earth Online: Faculty-Sourced Guidance from InTeGrate. Abstract ED53E-0197 presented at the 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
76. S. Semken, T. Ruberto, C. Mead, G. Bruce, S. Buxner, and A. D. Anbar (2017). Learning outcomes of in-person and virtual field-based geoscience instruction at Grand Canyon National Park: complementary mixed-methods analyses. Abstract ED31E-03 presented at the 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
77. *A. M. Sherry, S. J. Romaniello, P. Herckes, and A. D. Anbar (2017). Experimental Constraints on Iron Mobilization into Biomass Burning Aerosols. Abstract A31C-2179 presented at the 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
78. #A. J. Tamer, A. D. Anbar, L. T. Elkins-Tanton, S. Klug Boonstra, C. Mead, J. L. Swann, and D. Hunsley (2017). Building effective learning experiences around visualizations: NASA Eyes on the Solar System and Infiniscope. Abstract ED14A-04 presented at the 2017 Fall Meeting, AGU, New Orleans, LA, 11-15 Dec.
79. A. Anbar (2017) Designing an integrated theory of Earth system oxygenation. Geological Society of America Abstracts with Programs. Vol. 49, No. 6 doi: 10.1130/abs/2017AM-302163. **Invited.**

80. A. D. Anbar, C. Bentley, and S. Semken (2017). Proposing a digital teaching network for virtual field experiences. Geological Society of America Abstracts with Programs. Vol. 49, No. 6 doi: 10.1130/abs/2017AM-308015.
81. #G. Gilleaudeau, C. K. Junium, L. C. Kah, N. Zolotova, and A. D. Anbar (2017). No evidence for alternative nitrogenase expression in a Mesoproterozoic molybdenum-limited environment: constraints from nitrogen isotopes at 1.1 Ga. Geological Society of America Abstracts with Programs. Vol. 49, No. 6 doi: 10.1130/abs/2017AM-306732.
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83. *C. M. Ostrander, B. Kendall, S. J. Romaniello, G. W. Gordon, S. Olson, T. W. Lyons, S. G. Nielsen, W. Zheng, and A. D. Anbar (2017). Constraining the molybdenum isotope budget of 2.63 – 2.50 Ga oceans. Geological Society of America Abstracts with Programs. Vol. 49, No. 6 doi: 10.1130/abs/2017AM-306885.
84. T. Ruberto, C. Mead, S. Semken, G. Bruce, S. Buxner, and A. D. Anbar (2017). Contrasting, complementary learning outcomes of in-person and virtual field-based geoscience instruction at Grand Canyon National Park. Geological Society of America Abstracts with Programs. Vol. 49, No. 6 doi: 10.1130/abs/2017AM-306229.
85. *F. Zhang, T. J. Algeo, S. Romaniello, and A. D. Anbar (2017). Quantitative constraints on End-Permian and Early Triassic oceanic anoxia using high-resolution $\delta^{238}\text{U}$ records. Geological Society of America Abstracts with Programs. Vol. 49, No. 6 doi: 10.1130/abs/2017AM-303720.
86. #W. Zheng, G. J. Gilleaudeau, L. C. Kah, and A. D. Anbar (2017). Mercury stable isotopes as a novel proxy for photic zone euxinia. Geological Society of America Abstracts with Programs. Vol. 49, No. 6 doi: 10.1130/abs/2017AM-307848.
87. A. Anbar (2017) Designing an integrated theory of Earth's biogeochemical evolution. 27th V. M. Goldschmidt Conference, 13-18 August, Paris, France. **Honorary – Endowed Biogeochemistry Lecture.**
88. A. Anbar, C. Mead, V. Peters, L. Horodyskyj, and D. Ben-Naim (2017). Transforming STEM education through digital teaching networks. 27th V. M. Goldschmidt Conference, 13-18 August, Paris, France.
89. ¹M. Cheng, C. Li, F. Zhang, and A. Anbar (2017). Constrain the global redox state of post-Marinoan Ocean with paired Mo-U isotopes. 27th V. M. Goldschmidt Conference, 13-18 August, Paris, France.
90. #G. Gilleaudeau, R. Frei, A. Kaufman, G. Luo, S. Romaniello, F. Zhang, R. Kläebe, S. Sahoo, L. Kah, K. Azmy, J. Bartley, P. Chernyavskiy, A. Knoll, and A. Anbar (2017). Deciphering the

- carbonate record of Mesoproterozoic biospheric oxygenation: insights from chromium and uranium isotopes. 27th V. M. Goldschmidt Conference, 13-18 August, Paris, France. **Invited.**
91. #L. Horodyskyj, G. Bruce, L. McAllister, S. Semken, A. Anbar, and L. Hosman (2017). Online geoscience offline. 27th V. M. Goldschmidt Conference, 13-18 August, Paris, France.
 92. *A. C. Johnson, C. T. Reinhard S. J. Romaniello, E. Garcia-Robledo, N. P. Revsbech, D. Canfield, T. W. Lyons, and A. D. Anbar (2017). Archean oxidative weathering: insights from sulfide oxidation experiments at ultra-low pO₂. 27th V. M. Goldschmidt Conference, 13-18 August, Paris, France.
 93. *C. Ostrander, B. Kendall, S. Romaniello, G. Gordon, and A. Anbar (2017). Mo isotope evidence for a global expansion in marine euxinia ~ 2.5 billion years ago. 27th V. M. Goldschmidt Conference, 13-18 August, Paris, France.
 94. #S. J. Romaniello, F. Zhang, T. J. Algeo, and A. D. Anbar (2017). Constraining drivers of the End-Permian Mass Extinction using high-resolution records of marine anoxia. 27th V. M. Goldschmidt Conference, 13-18 August, Paris, France.
 95. *F. Zhang, S. Romaniello, B. Kendall, S. Xiao, and A. Anbar (2017). Global marine redox changes drove the rise and fall of the early animals. 27th V. M. Goldschmidt Conference, 13-18 August, Paris, France.
 96. A. Anbar, D. Ben-Naim, and C. Mead (2017). Digital Teaching Networks Inspired by Astrobiology: Adaptive Scaling of High-Quality Learning Resources. Abstract 3641 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
 97. D. D. Bratton III, J. Hayes, D. Sarno, G. Bruce, L. Horodyskyj, C. Mead, D. Ben-Naim, and A. D. Anbar (2017). Bringing active field-based learning to scale in astrobiology: virtual field trips and adaptive courseware. Abstract 3662 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
 98. *P. R. Castleberry, S. J. Romaniello, and A. D. Anbar (2017). The Possible Photochemical Origins of Banded Iron Formations. Abstract 3528 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
 99. *X. Chen, A. Sherry, S. J. Romaniello, J. Havig, M. McCormick, and A. D. Anbar (2017). Exploring molybdenum and uranium isotope fractionation across the chemocline of Fayetteville Green Lake, New York. Abstract 3603 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
 100. #L. B. Horodyskyj, C. Mead, and A. D. Anbar (2017). Teaching assumptions: the missing component of the scientific process. Abstract 3500 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
 101. *A. C. Johnson, C. T. Reinhard, S. J. Romaniello, A. Greaney, E. Garcia-Robledo, N. P. Revsbech, D. E. Canfield, T. W. Lyons, and A. D. Anbar (2017). Reconciling “whiffs” of O₂ with

- the Archean MIF S record: insights from sulfide oxidation experiments. Abstract 3584 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
102. #C. Mead, L. Horodyskyj, S. Buxner, S. Semken, and A. Anbar (2017). Advances in assessments of astrobiology learning outcomes and data-driven student support. Abstract 3625 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
 103. #A. A. Monroe, C. R. Glein, A. D. Anbar, E. L. Shock, and J. L. Lunine (2017). Amino acid destruction considerations for in situ measurements of Enceladus and other ocean worlds. Abstract 3319 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
 104. M. Neveu, A. D. Anbar, J. Baross, D. P. Glavin, C. P. McKay, C. C. Porco, B. Sherwood, Y. Takano, and H. Yano (2017). Quantitative planetary protection for sample return from ocean worlds. Abstract 3008 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
 105. *C. M. Ostrander, B. Kendall, G. W. Gordon, S. J. Romaniello, and A. D. Anbar (2017). The “whiff” of oxygen 2.5 billion years ago: global or local? Abstract 3709 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
 106. *V. Perera, C. Mead, S. Buxner, L. Horodyskyj, S. Semken, D. Lopatto, and A. D. Anbar (2017). Gauging students’ attitudes towards science to improve science pedagogy. Abstract 3690 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
 107. #S. J. Romaniello, F. Zhang, T. J. Algeo, and A. D. Anbar (2017). High-Resolution Reconstruction of Anoxia Across the End-Permian Mass Extinction from Composite Uranium Isotope Records. Abstract 3729 presented at the 2017 Astrobiology Science Conference, 24-28 April, Mesa, AZ.
 108. A. D. Anbar, L. T. Elkins-Tanton, S. Klug Boonstra, and D. Ben-Naim (2016). The Exploration Connection. Abstract ED24A-05 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec. **Invited.**
 109. A. D. Anbar, H. E. Hartnett, A. York, and C. Selin (2016). The Anthropocene: a planetary perspective. Abstract U13A-06 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec. **Invited.**
 110. D. Bratton, C. Mead, L. Horodyskyj, and A. D. Anbar (2016). Development and evaluation of a fully-online introductory biology course with an emphasis on the possibility of life beyond Earth. Abstract ED43A-0848 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
 111. #G. Bruce, C. Mead, S. Buxner, W. Taylor, S. C. Semken, A. D. Anbar, and J. Sundstrom (2016). Immersive, interactive virtual field trips promote learning. Abstract ED43A-0845 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
 112. #G. Bruce, W. Taylor, A. D. Anbar, S. C. Semken, S. Buxner, C. Mead, E. El-Moujaber, R. E. Summons, and C. Oliver (2016). Linking immersive virtual field trips with an adaptive learning

- platform. Abstract ED51H-0848 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
113. *P. Castleberry, S. J. Romaniello, and A. D. Anbar (2016). What do we really know about the origins of banded iron formations? Abstract V13E-2900 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
 114. *X. Chen, S. J. Romaniello, A. D. Herrmann, and A. D. Anbar (2016). Diagenetic effects on uranium isotope fractionation in carbonate sediments from the Bahamas. Abstract PP11B-2015 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
 115. #G. W. Gordon, S. J. Romaniello, J. Skulan, A. D. Anbar, S. M. Smith, and S. Zwart (2016). Astronaut bones: stable calcium isotopes in urine as a biomarker of bone mineral balance. Abstract PA44B-05 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
 116. K. Goto, J. R. Hein, G. Shimoda, S. Aoki, A. Ishikawa, K. Suzuki, G. W. Gordon, and A. D. Anbar (2016). Molybdenum isotopes in modern marine hydrothermal Fe/Mn deposits: implications for Archean and Paleoproterozoic Mo cycles. Abstract V13E-2895 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
 117. #L. Horodyskyj, C. Mead, and A. D. Anbar (2016). I assumed you knew: teaching assumptions as co-equal to observations in scientific work. Abstract ED21A-0763 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
 118. #L. Horodyskyj, C. Mead, S. Buxner, S. C. Semken, and A. D. Anbar (2016). Assessing complex learning objectives through analytics. Abstract ED41C-02 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
 119. *A. Johnson, C. T. Reinhard, S. J. Romaniello, A. T. Greaney, E. Garcia-Robledo, N-P. Revsbech, D. E. Canfield, T. W. Lyons, and A. D. Anbar (2016). Reconciling “whiffs” of O₂ with the Archean MIF S record: insights from sulfide oxidation experiments. Abstract V13B-2836 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
 120. #C. Mead, L. Horodyskyj, S. Buxner, S. C. Semken, and A. D. Anbar (2016). Different behavioral patterns of success for men and women in an online introductory science course: Addressing the course grade gender gap. Abstract ED41C-03 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
 121. #C. Mead, L. Horodyskyj, S. Buxner, S. C. Semken, and A. D. Anbar (2016). Measuring scientific reasoning through behavioral analysis in a computer-based problem solving exercise. Abstract ED43A-0846 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
 122. *V. Perera, C. Mead, S. Buxner, L. Horodyskyj, S. C. Semken, D. Lopatto, and A. D. Anbar (2016). Assessing student attitudes towards science in an adaptive online astrobiology Course: comparing online and on-campus undergraduates. Abstract ED43A-0847 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.

123. *C. M. Ostrander, B. Kendall, M. Roy, S. J. Romaniello, S. J. Nunn, G. W. Gordon, S. L. Olson, T. W. Lyons, W. Zhang, and A. D. Anbar (2016). Re-assessing the molybdenum isotope composition of pre-GOE seawater: evidence for dynamic ocean redox. Abstract V54A-03 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
124. #S. J. Romaniello, C. M. Ostrander, A. Johnson, N. Planavsky, and A. D. Anbar (2016). What the flux? Deriving empirical estimates of riverine Mo fluxes over Earth history. Abstract V13B-2834 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
125. S. C. Semken, T. Ruberto, C. Mead, G. Bruce, S. Buxner, and A. D. Anbar (2016). Complementary research on student geoscience learning at Grand Canyon by means of in-situ and virtual modalities. Abstract ED43A-0844 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
126. [†]H. Song, H. Song, T. J. Algeo, S. J. Romaniello, J. Tong, Y. Du, H. Wei, S. Shen, and A. D. Anbar (2016). Uranium isotope evidence for the abrupt onset of oceanic anoxia during the end-Guadalupian mass extinction. Abstract V51A-3044 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
127. *L. A. Tegler, A. M. Sherry, S. J. Romaniello, and A. D. Anbar (2016). Forest fires as a possible source of isotopically light marine Fe aerosols. Abstract A31C-0040 presented at the 2016 Fall Meeting, AGU, San Francisco, CA, 12-16 Dec.
128. S. Semken, G. Bruce, C. Mead, S. Buxner, W. L. Taylor, T. Ruberto, and A. D. Anbar (2016). Reinvigorating the traditional “historical geology” curriculum with immersive virtual field exploration of the history of Earth and life. *Geological Society of America Abstracts with Programs*. Vol. 48, No. 7 doi: 10.1130/abs/2016AM-285458
129. K. Goto, G. Shimoda, A. Anbar, G. Gordon, Y. Harigane, R. Senda, K. Suzucki, and J. Hein (2016). Molybdenum isotopes in marine hydrothermal Mn deposits. 26th V. M. Goldschmidt Conference, Yokohama, Japan, 26 June - 1 July.
130. *A. Johnson, C. T. Reinhard, S. J. Romaniello, E. Garcia-Robledo, N-P. Revsbech, D. E. Canfield, T. W. Lyons, and A. D. Anbar (2016). Mobilizing molybdenum: interpreting Archean oxidative weathering signatures. 26th V. M. Goldschmidt Conference, Yokohama, Japan, 26 June - 1 July.
131. #S. J. Romaniello, F. Zhang, T. Algeo, K. Lau, X. Chen, M. Elrick, A. Herrmann, and A. D. Anbar (2016). Validation of the carbonate $^{238}\text{U}/^{235}\text{U}$ paleoredox proxy: evidence from multiple localities spanning the Permian-Triassic Boundary. 26th V. M. Goldschmidt Conference, Yokohama, Japan, 26 June - 1 July. **Invited.**
132. S. Takahashi, G. W. Gordon, K. Ozaki, S-I. Yamasaki, K. Kimura, A. D. Anbar, R. Tada (2016). Variations of U and Mo isotopes across the deep sea Permian-Triassic Boundary. 26th V. M. Goldschmidt Conference, Yokohama, Japan, 26 June - 1 July.

133. *F. Zhang, C. Li, V. Melezhik, W. Shi, M. Cheng, B. Kendall, S. J. Romaniello, J. Owens, and A. Anbar (2016). Uranium isotope variation across the Ediacaran Shuram Excursion. V. M. Goldschmidt Conference, Yokohama, Japan, 26 June - 1 July.
134. A. D. Anbar and the Dynamics of Earth System Oxygenation Team (2015). Earth system oxygenation: toward an integrated theory of Earth evolution. Abstract U24A-08 presented at the 2015 Fall Meeting, AGU, San Francisco, CA, 14-18 Dec. **Invited.**
135. A. D. Anbar and the ETX Center Research and Evaluation Team (2015). Education through exploration: evaluating the unknown. Abstract ED53A-843 presented at the 2015 Fall Meeting, AGU, San Francisco, CA, 14-18 Dec. **Invited.**
136. *X. Chen, S. Romaniello, A. Herrmann, L. Wasylenki, and A. Anbar (2015). Uranium isotopes in calcium carbonate: a possible proxy for paleo-pH and carbonate ion concentration? Abstract PP33C-2334 presented at the 2015 Fall Meeting, AGU, San Francisco, CA, 14-18 Dec.
137. A. Herrmann, T. Algeo, G. Gordon, and A. Anbar (2015). Uranium isotopes as a potential global-ocean redox proxy: a test from the Upper Pennsylvanian Hushpuckney Shale (Kansas, U.S.A.). Abstract PP31B-2250 presented at the 2015 Fall Meeting, AGU, San Francisco, CA, 14-18 Dec.
138. #L. Horodyskyj, C. Mead, S. Buxner, S. Semken, and A. Anbar (2015). Data-driven design: learning from student experiences and behaviors. Abstract ED52A-0844 presented at the 2015 Fall Meeting, AGU, San Francisco, CA, 14-18 Dec.
139. *A. Johnson, S. Romaniello, C. Reinhard, E. Garcia-Robledo, N-P. Revsbech, D. Canfield, T. Lyons, and A. Anbar (2015). Oxidative weathering of Archean sulfides: implications for the Great Oxidation Event. Abstract PP31B-2251 presented at the 2015 Fall Meeting, AGU, San Francisco, CA, 14-18 Dec.
140. J. Owens, S. Nielsen, C. Ostrander, L. Peterson, and A. Anbar (2015). Development and applications of thallium isotopes: a new proxy tracking the extent of manganese oxide burial. Abstract PP33E-04 presented at the 2015 Fall Meeting, AGU, San Francisco, CA, 14-18 Dec. **Invited.**
141. *S. Rochelle, A. Anbar, H. Hartnett, S. Romaniello, and A. Poret-Pederson (2015). Developing a metal proxy for the rise of early terrestrial life. Abstract B21A-0415 presented at the 2015 Fall Meeting, AGU, San Francisco, CA, 14-18 Dec.
142. *F. Zhang, B. Kendall, H. Cui, A. D. Anbar, S. Xiao, and A. J. Kaufman (2015). An episode of widespread ocean anoxia during the latest Ediacaran period revealed by light U isotope compositions in carbonates. *Geological Society of America Abstracts with Programs* **47**: 705.
143. *F. Zhang, T. J. Algeo, S. J. Romaniello, A. D. Herrmann, S. Richoz, and A. D. Anbar (2015). Protracted global ocean anoxia delayed biotic recovery following the end-Permian mass extinction. *Geological Society of America Abstracts with Programs* **47**: 699.

144. S. Semken, G. Bruce, A. D. Anbar, S. Buxner, K. Karlstrom, and L. Crossey (2015). Complementary (not comparative) research on geoscience teaching and learning in virtual and in-situ field environments. *Geological Society of America Abstracts with Programs* **47**: 405.
145. A. D. Anbar (2015) Earth system oxygenation: toward an integrated theory of Earth evolution. 25th V. M. Goldschmidt Conference, Prague, Czech Republic, 16-21 August. **Invited (keynote)**.
146. A. D. Anbar, G. W. Gordon, J. L. Skulan, S. M. Smith, and R. Fonseca (2015). Developing a clinically useful calcium isotope biomarker. 25th V. M. Goldschmidt Conference, Prague, Czech Republic, 16-21 August. **Invited**.
147. #G. W. Gordon, J. L. Skulan, and A. D. Anbar (2015). Ca isotope fractionation during bone formation. 25th V. M. Goldschmidt Conference, Prague, Czech Republic, 16-21 August.
148. A. D. Herrmann, G. W. Gordon, and A. D. Anbar (2015). U isotope variations in a dolomitized Jurassic carbonate platform (Tithonian; Southern Germany). 25th V. M. Goldschmidt Conference, Prague, Czech Republic, 16-21 August.
149. S. Olson, M. Roy, T. Lyons, C. Ostrander, and A. D. Anbar (2015). Inorganic hints of Archean oxygenation in the ~2.7 Ga Roy Hill Shale. 25th V. M. Goldschmidt Conference, Prague, Czech Republic, 16-21 August.
150. *F. F. Zhang, S. J. Romaniello, T. J. Algeo, A. D. Hermann, and A. D. Anbar (2015). U isotope variation in marine carbonates across the Permian-Triassic Boundary. 25th V. M. Goldschmidt Conference, Prague, Czech Republic, 16-21 August.
151. A. D. Anbar, D. Ben-Naim, D. Schönstein, and L. Horodyskyj (2015). The Inspark Science Network: Using astrobiology to teach science as exploration of the unknown, not just mastery of the known. Abstract #7790 presented at the 2015 Astrobiology Science Conference, Chicago, IL, 15 – 19 June.
152. #G. Bruce, S. Semken, R. Summons, L. Horodyskyj, B. Kotrc, S. Buxner, J. Swann, S. Klug-Boonstra, C. Oliver, and A. D. Anbar (2015). Interactive technology enabling a virtual exploration of our evolving planet. Abstract #7619 presented at the 2015 Astrobiology Science Conference, Chicago, IL, 15 – 19 June.
153. #L. Horodykyj, S. Buxner, D. Schönstein, S. Semken, and A. Anbar (2015). Increasing the impact of coursework through deep analytics. Abstract #7411 presented at the 2015 Astrobiology Science Conference, Chicago, IL, 15 – 19 June.
154. B. Kendall, R. A. Creaser, C. T. Reinhard, T. W. Lyons, and A. D. Anbar (2015). Osmium isotope evidence for transient episodes of Late Archean environmental oxygenation and oxidative continental weathering. Abstract #7392 presented at the 2015 Astrobiology Science Conference, Chicago, IL, 15 – 19 June.
155. H. J. Sun, C. P. McKay, A. Anbar, and G. Levin (2015). False positives: lessons from Viking and a new way forward. Abstract #7384 presented at the 2015 Astrobiology Science Conference, Chicago, IL, 15 – 19 June.

156. *F. F. Zhang, S. J. Romaniello, T. J. Algeo, A. D. Hermann, and A. D. Anbar (2015). U isotope variation in marine carbonates across the Permian-Triassic Boundary. Abstract #7629 presented at the 2015 Astrobiology Science Conference, Chicago, IL, 15 – 19 June.
157. A. Anbar, G. Bruce, S. Semken, R. Summons, S. Buxner, L. Horodyskij, B. Kotrc, J. Swann, S. Klug Boonstra, and C. Oliver (2014). Virtual exploration of Earth's evolution. Abstract ED34A-03 presented at the 2014 Fall Meeting, AGU, San Francisco, CA, 15-19 Dec.
158. #G. Bruce, A. Anbar, S. Semken, R. Summons, C. Oliver, and S. Buxner (2014). iVFTs - immersive virtual field trips for interactive learning about Earth's environment. Abstract ED52A-1141 presented at the 2014 Fall Meeting, AGU, San Francisco, CA, 15-19 Dec.
159. *X. Chen, S. Romaniello, A. Herrmann, L. Wasylenki and A. Anbar (2014). Uranium isotope fractionation during coprecipitation with aragonite and calcite. Abstract PP51C-1141 presented at the 2014 Fall Meeting, AGU, San Francisco, CA, 15-19 Dec.
160. ¹K. Goto, T. Ito, K. Suzuki, A. Anbar, G. Gordon, T. Kashiwabara, Y. Takaya, G. Shimoda, T. Nozaki, S. Kiyokawa, G. Tetteh and F. Nyame (2014). A highly oxidized atmosphere-ocean system and oceanic molybdenum drawdown during the Paleoproterozoic. Abstract P11C-3786 presented at the 2014 Fall Meeting, AGU, San Francisco, CA, 15-19 Dec.
161. #L. Horodyskyj, D. Schönstein, S. Buxner, S. Semken and A. Anbar (2014). Increasing Impact of Coursework Through Deep Analytics. Abstract ED31B-3437. presented at the 2014 Fall Meeting, AGU, San Francisco, CA, 15-19 Dec.
162. ¹S. Olson, C. Reinhard, N. Planavsky, T. Lyons, M. Roy and A. Anbar (2014). Oxygen oases before and after the GOE: insights from metals and models. Abstract P12A-08 presented at the 2014 Fall Meeting, AGU, San Francisco, CA, 15-19 Dec. **Invited.**
163. *H. Smith, H. Kim, S. Romaniello, P. Field and A. Anbar (2014). A robust and fully-automated chromatographic method for the quantitative purification of Ca and Sr for isotopic analysis. Abstract PP51C-1143 presented at the 2014 Fall Meeting, AGU, San Francisco, CA, 15-19 Dec.
164. #M. Roy, C. Ostrander, T. Lyons, S. Olson, R. Buick and A. Anbar (2014). Preliminary results from the AIDP-2 and AIDP-3 drill cores hint at systematic Mo enrichments in the ~2.65 Ga Roy Hill Shale. Abstract PP53A-1184 presented at the 2014 Fall Meeting, AGU, San Francisco, CA, 15-19 Dec.
165. #G. Bruce, S. Semken, A. D. Anbar, K. E. Karlstrom, L. J. Crossery (2014). Explore and study Grand Canyon by immersive virtual field trip! *Geological Society of America Abstracts with Programs* **46**: 91.
166. #B. Kendall, R. A. Creaser, C. T. Reinhard and A. D. Anbar (2014). Confirmation of minimal post-depositional disturbance of rhenium and osmium in the 2.50 Ga Mt. McRae shale and osmium isotope evidence for Late Archean oxidative weathering. *Geological Society of America Abstracts with Programs* **46**: 201.

167. *C. Mead, S. Semken, A. D. Anbar (2014). The development of a valid and reliable biogeochemistry concept inventory. *Geological Society of America Abstracts with Programs* **46**: 312.
168. A. I. Sheen, B. Kendall, C. Reinhard, A. D. Anbar, R. A. Creaser, T. Lyons, A. Bekker, S. W. Poulton (2014). Quantitative constraints on the extent of Middle Proterozoic ocean anoxia from modeling of the oceanic mass balance of rhenium. *Geological Society of America Abstracts with Programs* **46**: 581.
169. [†]K. Goto, A. Anbar, G. Gordon, S. Romaniello, G. Shimoda, Y. Takaya, A. Tokumaru, T. Nozacki, K. Suzuki, S. Machida, T. Hanyu and A. Usui (2014). Uranium isotope in ferromanganese crusts: implications for the marine $^{238}\text{U}/^{235}\text{U}$ isotope system. 24th V. M. Goldschmidt Conference, Sacramento, CA, 8-13 June.
170. *X. Chen, S. Romaniello, A. Herrmann, L. Wasylenki and A. Anbar (2014). Uranium isotope fractionation during incorporation into aragonite and calcite. 24th V. M. Goldschmidt Conference, Sacramento, CA, 8-13 June.
171. *S. J. Romaniello, A. D. Herrmann and A. D. Anbar (2014). Progress, pitfalls, and future directions developing the $\delta^{238}\text{U}$ paleoredox proxy. 24th V. M. Goldschmidt Conference, Sacramento, CA, 8-13 June.
172. [†]T. W. Dahl, A. D. Anbar, G. W. Gordon and D. E. Canfield (2014). Iron cycling in Neoproterozoic ferruginous oceans. 24th V. M. Goldschmidt Conference, Sacramento, CA, 8-13 June.
173. A. D. Anbar (2013). Isotope innovations. Abstract PP44B-04 presented at the 2013 Fall Meeting, AGU, San Francisco, CA, 8-13 Dec. **Invited.**
174. D. R. Bell and A. D. Anbar (2013). Oxygen titration of continental lithosphere and the rise of atmospheric O₂. Abstract V41E-05 presented at the 2013 Fall Meeting, AGU, San Francisco, CA, 8-13 Dec.
175. [#]L. Horodyskyj, D. Ben-Naim, S. C. Semken and A. D. Anbar (2013). Transforming the online course. Abstract^[SEP]ED53E-0673 presented at the 2013 Fall Meeting, AGU, San Francisco, CA, 8-13 Dec.
176. *M. Neveu, A. T. Poret-Peterson, A. D. Anbar and J. J. Elser (2013). Ordinary stoichiometry of extraordinary microbes. Abstract B23F-0605 presented at the 2013 Fall Meeting, AGU, San Francisco, CA, 8-13 Dec.
177. S. K. Sahoo, G. Jiang, N. J. Planavsky, B. Kendall, J. D. Owens, A. D. Anbar and T. W. Lyons (2013). Ediacaran redox fluctuations. Abstract PP44B-05 presented at the 2013 Fall Meeting, AGU, San Francisco, CA, 8-13 Dec.

178. #G. W. Gordon, J. Monge, M. B. Channon, Q. Wu, J. Skulan, A. D. Anbar and R. Fonseca (2013). Calcium isotopic composition and its association with multiple myeloma disease activity. Abstract presented at the 55th American Society of Hematology Annual Meeting and Exposition, New Orleans, LA, Dec. 7-10.
179. A. D. Anbar, L. Horodyskyj, D. Ben-Naim and S. Semken (2013). Innovation online: inverting the lecture-lab paradigm in science education. *Geological Society of America Abstracts with Programs* **45**: 656.
180. #G. Bruce, A. D. Anbar, K. E. Karlstrom and L. J. Crossey (2013). Virtual field exploration of Grand Canyon geology and geologic history. *Geological Society of America Abstracts with Programs* **45**: 399.
181. M. Elrick, T. J. Algeo, V. J. Polyak, L. Zhao, Z. Q. Chen, A. Herrmann Y. Asmerom and A. D. Anbar (2013). Late Permian through early Triassic marine redox and continental weathering flux patterns interpreted from U and Nd isotopes: implications for end-Permian extinction models. *Geological Society of America Abstracts with Programs* **45**: 89.
182. S. K. Sahoo, G. Jiang, N. J. Planavsky, B. Kendall, J. D. Owens, A. D. Anbar and T. W. Lyons (2013). Turbulent times for early animals? *Geological Society of America Abstracts with Programs* **45**: 754.
183. A. Anbar and T. Lyons (2013). Redox-sensitive metals and their isotopes: the Holland legacy of early ocean exploration. Abstract presented at the 23rd V. M. Goldschmidt Conference, Florence, Italy, 25-30 August. *Mineralogical Magazine* **77**: 590.
184. #M. Channon, G. Gordon, Q. Schollenberger, J. Morgan, S. Smith and A. Anbar (2013). Understanding controls on Ca isotopes in human blood and urine. Abstract presented at the 23rd V. M. Goldschmidt Conference, Florence, Italy, 25-30 August. *Mineralogical Magazine* **77**: 853.
185. G. Gordon, J. Skulan, M. Channon, R. Fonseca and A. Anbar (2013). Early detection of osteolytic lesions in multiple myeloma using natural Ca isotopes. Abstract presented at the 23rd V. M. Goldschmidt Conference, Florence, Italy, 25-30 August. *Mineralogical Magazine* **77**: 1198.
186. A. Herrmann, T. Algeo, S. Romaniello, G. Gordon and A. Anbar (2013). Molybdenum and uranium isotope dynamics in a paleozoic epicontinental black shale. Abstract presented at the 23rd V. M. Goldschmidt Conference, Florence, Italy, 25-30 August. *Mineralogical Magazine* **77**: 1293.
187. R. Fonseca, J. Skulan, G. Gordon, and A. D. Anbar (2013). Early detection of osteolytic lesions in multiple myeloma using natural Ca isotopes. 14th International Myeloma Workshop, Kyoto, Japan. April 3-7.
188. A. D. Anbar, J. Skulan, G. Gordon and J. Morgan (2013). Metallomic markers in medicine. Abstract presented at the Pittcon 2013 Conference, Philadelphia, PA, March 17-21. **Invited**.

189. A. D. Anbar, B. Kendall, C. Reinhard and T. W. Lyons (2012). Evidence of environmental oxygenation before the Great Oxidation Event: a status report. Abstract B54B-02 presented at the 2012 Fall Meeting, AGU, San Francisco, CA, 3-7 Dec.
190. M. P. Field, S. J. Romaniello, G. W. Gordon and A. D. Anbar (2012). Automated sample preparation for radiogenic and non-traditional metal isotope analysis by MC-ICP-MS. Abstract V23B-2823 presented at the 2012 Fall Meeting, AGU, San Francisco, CA, 3-7 Dec.
191. A. D. Herrmann, G. W. Gordon, S. J. Romaniello, T. J. Algeo and A. D. Anbar (2012). Spatial heterogeneity of uranium isotope variations in a Phanerozoic, epicontinental black shale (Hushpuckney Shale, Swope Formation). Abstract B11G-04 presented at the 2012 Fall Meeting, AGU, San Francisco, CA, 3-7 Dec.
192. A. Marcotte, B. J. Majestic, A. D. Anbar and P. Herckes (2012). The effect of particle size on iron solubility in atmospheric aerosols. Abstract A33D-0203 presented at the 2012 Fall Meeting, AGU, San Francisco, CA, 3-7 Dec.
193. *C. Mead, P. Herckes, B. J. Majestic and A. D. Anbar (2012). Quantifying anthropogenic Fe in marine aerosols using Fe stable isotope analysis. Abstract OS41A-1698 presented at the 2012 Fall Meeting, AGU, San Francisco, CA, 3-7 Dec.
194. *A. A. Monroe, P. Williams and A. D. Anbar (2012). Sampling and analysis of organic molecules in the plumes of Enceladus. Abstract P32A-07 presented at the 2012 Fall Meeting, AGU, San Francisco, CA, 3-7 Dec.
195. *M. Neveu, A. T. Poret-Peterson, Z. M. Lee, A. D. Anbar and J. J. Elser (2012). Cell-sediment separation and elemental stoichiometries in extreme environments. Abstract B51D-0583 presented at the 2012 Fall Meeting, AGU, San Francisco, CA, 3-7 Dec.
196. #A. T. Poret-Peterson, S. J. Romaniello, M. Bose, P. Williams, J. J. Elser, E. Shock, A. D. Anbar and H. E. Hartnett (2012). Abstract B51G-0646 presented at the 2012 Fall Meeting, AGU, San Francisco, CA, 3-7 Dec.
197. P. Tsou, I. Kanik, D. Brownlee, C. McKay, A. Anbar, D. Glavin and H. Yano (2012). Returning samples from Enceladus. Abstract P33A-1920 presented at the 2012 Fall Meeting, AGU, San Francisco, CA, 3-7 Dec.
198. H. Pacheco, W. L. Taylor, S. Semken, A. E. Benbow, C. Mably, I. MacGregor, A. D. Anbar and W. Burelson (2012). Leveraging resources: AGI-ASU-NASA triad model for Earth and space science teacher professional development. *Geological Society of America Abstracts with Programs* **44**: 574.
199. A. Herrmann, S. Romaniello, P. Reid and A. Anbar (2012). U isotopes in marine calcareous algae: a paleo-redox proxy? Abstract presented at the 22nd V. M. Goldschmidt Conference, Montreal, Canada, 24-29 June.

200. #A. Kelly, T. Lyons, E. Alsop, G. Love, N. Planavsky, B. Kendall and A. Anbar (2012). Geochemical perspectives on local versus global ocean redox at 1.64 Ga. Abstract presented at the 22nd V. M. Goldschmidt Conference, Montreal, Canada, 24-29 June. **Invited.**
201. #B. Kendall, A. Anbar, R. Creaser, T. Lyons, A. Bekker and S. Poulton (2012). Rhenium data from shales confirms ferruginous Proterozoic deep oceans. Abstract presented at the 22nd V. M. Goldschmidt Conference, Montreal, Canada, 24-29 June.
202. N. Monga, S. J. Romaniello and A. D. Anbar (2012). Isotopic fractionation of U(VI) during reduction by sulphide. Abstract presented at the 22nd V. M. Goldschmidt Conference, Montreal, Canada, 24-29 June.
203. *S. J. Romaniello, A. D. Herrmann and A. D. Anbar (2012). Incorporation and early diagenesis of Mo and U isotope records in Bahamian carbonate sediments. Abstract presented at the 22nd V. M. Goldschmidt Conference, Montreal, Canada, 24-29 June. **Invited.**
204. *S. R. Romaniello, G. Gordon, D. Wiederin, M. P. Field and A. D. Anbar (2012). Automated sample purification: Radiogenic and non-traditional metal isotopes in the 21st century. Abstract presented at the 22nd V. M. Goldschmidt Conference, Montreal, Canada, 24-29 June.
205. S. Sahoo, N. Planavsky, B. Kendall, X. Wang, X. Shi, A. Anbar, T. Lyons and G. Jiang (2012). Ocean redox changes in the wake of the Marinoan glaciation. Abstract presented at the 22nd V. M. Goldschmidt Conference, Montreal, Canada, 24-29 June.
206. A. D. Anbar, Y. Duan, B. Kendall, C. Reinhard, S. Severmann and T. W. Lyons (2011). A Multi-Proxy Paradigm in the Pursuit of Ocean Paleoredox. Abstract PP41E-05 presented at the 2011 Fall Meeting, AGU, San Francisco, CA, 4-9 Dec. **Invited.**
207. *G. L. Arnold, T. W. Lyons, G. W. Gordon and A. D. Anbar (2011). Extreme change in sulfide concentrations near the Bosphorus Inlet (Black Sea) during the Little Ice Age tracked using molybdenum isotopes. Abstract PP51B-1846 presented at the 2011 Fall Meeting, AGU, San Francisco, CA, 4-9 Dec.
208. #L. Horodyskyj, D. Ben-Naim, A. D. Anbar and S. Semken (2011). Hunting for habitable worlds: engaging students in an adaptive online setting. Abstract ED24B-08 presented at the 2011 Fall Meeting, AGU, San Francisco, CA, 4-9 Dec.
209. K. Noonan, A. D. Anbar, F. Garcia-Pichel, A. T. Poret-Peterson and H. E. Hartnett (2011). Six siderophore-producing microorganisms identified in biological soil crusts. Abstract B32A-04 presented at the 2011 Fall Meeting, AGU, San Francisco, CA, 4-9 Dec.
210. J. Skulan, G. W. Gordon, J. Morgan, S. J. Romaniello, S. M. Smith and A. D. Anbar (2011). Natural Ca isotope composition of urine as a rapid measure of bone mineral balance. Abstract B54D-08 presented at the 2011 Fall Meeting, AGU, San Francisco, CA, 4-9 Dec.
211. *C. Mead, S. Semken and A. D. Anbar (2011). Identifying misconceptions about biogeochemistry among undergraduates. *Geological Society of America Abstracts with Programs* **43**: 68.

212. A. D. Anbar, B. Kendall, C. T. Reinhard and T. W. Lyons (2011). Whither the whiff? *Mineral. Mag.* **75**: 433. **Keynote**.
213. #B. Kendall, T. Komiya, T. W. Lyons, S. M. Bates, G. Jiang, R. A. Creaser, S. Xiao, K. McFadden, Y. Sawaki, M. Tahata, D. Shu, J. Han, Y. Li, X. Chu and A. D. Anbar (2011). First episode of widespread ocean oxygenation 551 Myr ago. *Mineral. Mag.* **75**: 1168. **Invited**.
214. T. W. Lyons, G. L. Arnold, A. Chappaz, B. C. Gill, N. J. Planavsky, C. T. Reinhard, N. Riedinger, C. T. Scott and A. D. Anbar (2011). Molybdenum as a paleoredox proxy: An update. *Mineral. Mag.* **75**: 1373. **Keynote**.
215. *J. L. L. Morgan, G. W. Gordon, S. J. Romaniello, J. L. Skulan, S. M. Smith and A. D. Anbar (2011). Rapidly assessing changes in bone mineral balance using natural stable calcium isotopes. *Mineral. Mag.* **75**: 1501.
216. #A. T. Poret-Peterson, S. J. Romaniello, N. Zolotova, Z. Martinez, J. J. Elser and A. D. Anbar (2011). Methylothrophy in Yellowstone National Park hot springs. *Mineral. Mag.* **75**: 1660.
217. *S. J. Romaniello, H. E. Hartnett, A. D. Anbar, J. J. Elser and E. L. Shock (2011). Nitrogen limitation in extremophilic hydrothermal ecosystems of Yellowstone National Park. *Mineral. Mag.* **75**: 1746.
- S. K. Sahoo, G. Jiang, B. Kendall, N. J. Planavsky, X. Wang, X. Shi, A. D. Anbar and T. W. Lyons (2011). An oxygen window for early Ediacaran animal life. *Mineral. Mag.* **75**: 1778.
218. C. T. Scott, N. Planavsky, B. Kendall, B. Wing, A. Bekker, A. D. Anbar and T. W. Lyons (2011). Tracking Archean seawater trace metal inventories through multi-proxy analysis of euxinic black shales. *Mineral. Mag.* **75**: 1831. **Invited**.
219. L. E. Wasylenki, E. B. Wilkes and A. D. Anbar (2011). Is your clean lab full of zinc? *Mineral. Mag.* **75**: 2135.
220. S. Weyer, C. Montoya-Pino, G. W. Gordon, B. van de Schootbrugge, W. Oschmann, J. Pross and A. D. Anbar (2011). The extent of oceanic anoxic events revealed by correlated Mo- and U isotopes records. *Mineral. Mag.* **75**: 2151.
221. J. Owens, T. W. Lyons, S. Severmann, B. Gill, H. Jenkyns, M. M. M. Kuypers, G. Gordon, A. Anbar and W. Kuhn (2011). Global Perturbation of the Marine Iron Cycle During OAE-2. Climate and Ocean Dynamics of the Cretaceous Greenhouse World
222. A. E. Kelly, G. D. Love, T. W. Lyons and A. D. Anbar (2010). An integrated organic-inorganic geochemical study of the 1.64 Ga Barney Creek Formation in Australia. Abstract B51G-0429 presented at 2010 Fall Meeting, AGU, San Francisco, CA, 13-17 Dec. **Invited**.
223. #B. Kendall, G. W. Gordon, S. Poulton and A. D. Anbar (2010). Molybdenum isotope constraints on the extent of late Paleoproterozoic ocean euxinia. Abstract OS33E-1513 presented at 2010 Fall Meeting, AGU, San Francisco, CA, 13-17 Dec.

224. *C. Mead, A. D. Anbar, J. R. Lyons and T. M. Johnson (2010). Mass-independent fractionation of mercury isotopes in compact fluorescent light bulbs. Abstract V31B-2325 presented at 2010 Fall Meeting, AGU, San Francisco, CA, 13-17 Dec.
225. #A. T. Poret-Peterson, R. Schwegel, J. J. Elser, E. Shock and A. D. Anbar (2010). Diversity of membrane-bound nitrate reductase genes in geothermal springs. Abstract B51A-0335 presented at 2010 Fall Meeting, AGU, San Francisco, CA, 13-17 Dec.
226. R. Raiswell, C. Reinhard, A. Derkowski and A. D. Anbar (2010). Environmental changes recorded by syngenetic and early diagenetic iron minerals in the late Archean Mt. McRae Shale. Abstract B52B-03 presented at 2010 Fall Meeting, AGU, San Francisco, CA, 13-17 Dec.
227. #L. E. Wasylenki, G. Brennecka, J. Bargar, S. Weyer and A. D. Anbar (2010). EXAFS reveals the mechanism of U isotope fractionation during adsorption to Mn oxyhydroxide. Abstract PP22A-07 presented at 2010 Fall Meeting, AGU, San Francisco, CA, 13-17 Dec.
228. W. B. Wilkes, L. E. Wasylenki and A. D. Anbar (2010). Zinc finger takes on a whole new meaning: reducing and monitoring zinc blanks in the isotope lab. Abstract V51B-2183 presented at 2010 Fall Meeting, AGU, San Francisco, CA, 13-17 Dec.
229. A. Herrmann, T. J. Algeo and A. D. Anbar (2010). Do uranium isotopes of epicontinental black shales reflect global oceanic conditions? *Geological Society of America Abstracts with Programs* **42**: 467.
230. T. W. Lyons, A. D. Anbar, A. Bekker, B. Kendall, C. Li, G. D. Love, P. Mcgoldrick, N. J. Planavsky, R. Raiswell, C. T. Reinhard, C. Scott (2010). New view of the old ocean: a prevalence of deep iron and marginalized sulfide from the late archean through the proterozoic. *Geological Society of America Abstracts with Programs* **42**: 560.
231. R. Raiswell, C. Reinhard, A. Derkowski, J. Owens, S. Bottrell, A. D. Anbar and T. W. Lyons (2010). Formation of syngenetic and early diagenetic iron minerals in the late Archean Mt. McRae Shale: paleoceanographic implications. *Geological Society of America Abstracts with Programs* **42**: 560.
232. #L. E. Wasylenki, L. J. Liermann, J. Nuester, A. D. Anbar, S. L. Brantley (2010). Fe isotope fractionation and kinetics of Fe release during dissolution of two very different amphiboles. *Geological Society of America Abstracts with Programs* **42**: 557.
233. A. D. Anbar, Y. Duan and B. Kendall (2010). Early oxygen. GeoCanada 2010, Calgary, Alberta, CA, 10-14 May. **Invited**.
234. K. Alexander, K. Lui, T. Viliboroghi, A. Anbar, F. Garcia-Pichel, and H. E. Hartnett (2010). Response of biological soil crusts to porewater metal additions. Astrobiology Science Conference 2010, League City, TX, 26-29 April.
235. A. D. Anbar (2010). Habitable Worlds: astrobiology meets sustainability in the virtual realm. Astrobiology Science Conference 2010, League City, TX, 26-29 April. **Invited**.

236. A. D. Anbar, Y. Duan and B. Kendall (2010). Early oxygen. Astrobiology Science Conference 2010, League City, TX., 26-29 April. **Invited.**
237. A. D. Anbar, E. S. Boyd, R. Buick, M. Claire, D. Des Marais, D. Domagal-Goldman, J. Eigenbrode, D. Erwin, K. Freeman, R. Hazen, C. Johnson, T. Lyons, V. Meadows, H. Ohmoto, S. Ono, J.W. Peters, B. Shapiro, R. Summons and M. Walter (2010). An Archean Biosphere Initiative. Astrobiology Science Conference 2010, League City, TX, 26-29 April. **Invited.**
238. E. S. Boyd, A. D. Anbar, S. Miller, T. L. Hamilton, M. Lavin and J. W. Peters (2010). An early origin for molybdenum-nitrogenase. Astrobiology Science Conference 2010, League City, TX, 26-29 April.
239. #J. B. Glass, F. L. Wolfe-Simon, A. T. Poret-Peterson and A. D. Anbar (2010). Signatures of low-Mo ancient ocean may be preserved in cyanobacterial genomes. Astrobiology Science Conference 2010, League City, TX. Astrobiology Science Conference 2010, League City, TX, 26-29 April.
240. H. E. Hartnett, S. Romaniello, B. Johnson, M. Kyle, T. Anderson, A. D. Anbar, J. Elser and E. Shock (2010). Geochemical evidence for denitrification in a Yellowstone National Park hot spring. Astrobiology Science Conference 2010, League City, TX, 26-29 April.
241. #B. Kendall, G. Brennecka, S. Weyer and A. D. Anbar (2010). Onset of oxidative uranium mobilization on the late Archean Earth? Astrobiology Science Conference 2010, League City, TX, 26-29 April.
242. #A. T. Poret-Peterson, R. Schwegel, M. Knowlton, J. J. Elser, E. L. Shock and A. D. Anbar (2010). Denitrification in hot environments: a gene perspective. Astrobiology Science Conference 2010, League City, TX, 26-29 April.
243. J. D. Blum, A. D. Anbar (2010). Mercury isotopes in the late Archean Mount McRae Shale, *Geochim. Cosmochim. Acta* **74**: A98.
244. T. W. Dahl, E. Hammarlund, A. H. Knoll, A.D. Anbar, D. E. Canfield (2010). Ocean oxygenation after the rise of animals. *Geochim. Cosmochim. Acta* **74**: A202.
245. *C. Mead, A. D. Anbar, T. M. Johnson (2010). Mass-independent fractionation of Hg isotopes resulting from photochemical self-shielding, *Geochim. Cosmochim. Acta* **74**: A693.
246. S. Severmann, J. Mcmanus, R. Poulson-Brucker, J. Owens, T. Lyons, A. Anbar, G. Gordon (2010). Of modern lakes and ancient oceans: Trace metals and their isotopes in an anoxic African rift lake. *Geochim. Cosmochim. Acta* **74**: A936.
247. #L. E. Wasylenki, G. A. Brennecka, J. R. Bargar, A. D. Anbar (2010). The mechanism of uranium isotope fractionation during adsorption to Mn oxyhydroxide. *Geochim. Cosmochim. Acta* **74**: A1116.

248. K. Alexander, D. Lui, A. D. Anbar, G. Garcia-Pichel and H. E. Hartnett (2009). Effect of nitrogen and metal additions on nitrogen fixation activity in biological soil crusts. *EOS Trans. AGU* **90**, Fall Meeting Supplement, Abstract EP53C-0628.
249. #B. Kendall, C. Reinhard, T. W. Lyons, A. J. Kaufman and A. D. Anbar (2009). Late Archean surface ocean oxygenation. *EOS Trans. AGU* **90**, Fall Meeting Supplement, Abstract B12A-01. **Invited.**
250. C. Reinhard, R. Raiswell, C. Scott, A. D. Anbar and T. W. Lyons (2009). Oxidative weathering and euxinia in the Late Archean. *EOS Trans. AGU* **90**, Fall Meeting Supplement, Abstract B12A-03. **Invited.**
251. *S. J. Romaniello, G. Brennecka, A. D. Anbar and A. S. Colman (2009). Natural isotopic fractionation of $^{238}\text{U}/^{235}\text{U}$ in the water column of the Black Sea. *EOS Trans. AGU* **90**, Fall Meeting Supplement, Abstract V54C-06.
252. #L. E. Wasylenki, G. Montanez and A. D. Anbar (2009). Cd isotope fractionation during adsorption varies with salinity. *EOS Trans. AGU* **90**, Fall Meeting Supplement, Abstract V11C-1977.
253. S. Weyer, G. Brennecka, C. Montoya Pino, J. Noordmann, E. A. Schauble, M. Wadhwa and A. D. Anbar (2009). Natural variation of $^{238}\text{U}/^{235}\text{U}$ in geo- and cosmochemistry. *EOS Trans. AGU* **90**, Fall Meeting Supplement, Abstract V54C-05.
254. *G. A. Brennecka, A. D. Herrmann, M. R. Saltzman and A. D. Anbar (2009). Using $^{238}\text{U}/^{235}\text{U}$ ratios in carbonates as a paleoredox indicator: variations across the Permian-Triassic boundary. *Geological Society of America Abstracts with Programs* **41**: 566.
255. #B. Kendall, C. Reinhard, T. W. Lyons, A. J. Kaufman and A. D. Anbar (2009). Surface ocean oxygenation preceded the Great Oxidation Event. *Geological Society of America Abstracts with Programs* **41**: 45.
256. †T. W. Dahl, A. D. Anbar, G. W. Gordon, M. T. Rosing, R. E. Frei, and D. E. Canfield (2009). Do $\delta^{98}\text{Mo}$ values in marine euxinic sediments reflect seawater? *Geochim. Cosmochim. Acta* **73**: A257 Suppl.
257. B. C. Gill, B. C., T. W. Lyons, T. Dahl, M. Saltzman, G. Gordon and A. D. Anbar (2009). Multiple geochemical proxies reveal a Late Cambrian ocean anoxic event. *Geochim. Cosmochim. Acta* **73**: 436 Suppl. **Invited.**
258. T. W. Lyons, C. Scott, C. Reinhard and A. D. Anbar (2009). Euxinia in the Proterozoic ocean, trace metal abundances, and the potential impacts on life. *Geochim. Cosmochim. Acta* **73**: A807 Suppl. **Invited.**
259. C. Montoya Pino, S. Weyer, B. van de Schootbrugge, A. D. Anbar, H. W. Arz, W. Oschmann and J. Pross (2009). Global versus regional anoxia during the OAE-2 and the T-OAE. *Geochim. Cosmochim. Acta* **73**: A897 Suppl.

260. #L. E. Wasylenki, C. L. Weeks, T. G. Spiro, J. R. Bargar and A. D. Anbar (2009). How Mo isotopes fractionate during adsorption to Mn and Fe oxyhydroxides. *Geochim. Cosmochim. Acta* **73**: A1419 Suppl. **Keynote**.
261. S. Weyer, G. Brennecke, J. Zipfel, M. Wadhwa and A. D. Anbar (2009). U isotope variations in CAIs: Implications for the age of the Solar System. *Geochim. Cosmochim. Acta* **73**: A1433 Suppl.
262. E. A. Prevedorou, M. Diaz-Zorita Bonilla, J. E. Buikstra, G. Gordon, A. Anbar and K. J. Knudson (2009). Residential mobility and dietary patterns at the prehistoric site of Gatas, Southeastern Spain. Annual Meeting of the American Association of Physical Anthropologists.
263. T. Algeo, G. Gordon, A. Anbar, P. Sauer, L. Schwark, S. Bates, T. Lyons, S. Turgeon, R. Creaser, B. Nabbfeld and K. Grice (2008). New insights on the Frasnian/Famennian mass extinction: a role for soil erosion? *Eos Trans. AGU* **89**, Fall Meet. Suppl., Abstract PP33D-04.
264. A. D. Anbar and F. Wolfe-Simon (2008). The bioinorganic bridge between life and environment. *Eos Trans. AGU* **89**, Fall Meet. Suppl., Abstract PP14A-01. **Invited**.
265. K. Bradley, B. Weiss, L. Carporzen, A. Anbar and R. Buick (2008). Paleomagnetism of the Astrobiology Drilling Project 8 drill core, Pilbara, Western Australia: implications for the early geodynamo and Archean tectonics. *Eos Trans. AGU* **89**, Fall Meet. Suppl., Abstract V12B-04.
266. J. Crawford, J. Black, L. Wasylenki, G. Gordon, A. Anbar and A. Kavner (2008). Electrochemical fractionation of molybdenum stable isotopes. *Eos Trans. AGU* **89**, Fall Meet. Suppl., Abstract B21B-0361.
267. *J. B. Glass, F. Wolfe-Simon and A. D. Anbar (2008). Molybdenum storage in cyanobacteria: “mopping” up excess Mo. *Eos Trans. AGU* **89**, Fall Meet. Suppl., Abstract B21B-0343.
268. T. W. Lyons, C. Scott, B. C. Gill and A. D. Anbar (2008). Trace Metals in the Early Ocean, Biological Implications, and Evolving Biospheric Redox. *Eos Trans. AGU* **89**, Fall Meet. Suppl., Abstract B24C-02.
269. C. T. Reinhard, R. Raiswell, A. Anbar and T. Lyons (2008). An Episode of Late Archean Euxinia and Enhanced Continental Weathering Revealed by Iron Speciation in the Mt. McRae Shale. *Eos Trans. AGU* **89**, Fall Meet. Suppl., Abstract PP21B-1411.
270. M. A. Saito, E. M. Bertrand and A. Anbar (2008). Neoproterozoic Oxygenation of Earth Surface Environments Reflected in the Late Evolution of the O₂-Dependent Vitamin B12 Biosynthesis Pathway. *Eos Trans. AGU* **89**, Fall Meet. Suppl., Abstract B24C-04.
271. A. D. Anbar and M. Claire (2008). O₂ variability in Archean environments: do whiffs trump tiffs? *Geochim. Cosmochim. Acta* **72**: A22 Suppl. **Invited**.
272. A. D. Anbar and G. W. Gordon (2008). Redox renaissance. *Geochim. Cosmochim. Acta* **72**: A22 Suppl. **Keynote**.

273. *G. Brennecka, L. E. Wasylenki, S. Weyer and A. D. Anbar (2008). Experiments demonstrate that Uranium isotopes fractionate during adsorption to Mn-oxides. *Geochim. Cosmochim. Acta* **72**: A114 Suppl.
274. [†]T. W. Dahl, A. D. Anbar, G. W. Gordon, M. T. Rosing, R. E. Frei and D. E. Canfield (2008). Molybdenum isotope variations in a redox-stratified lake; Removal mechanism and preservation in euxinic sediments. *Geochim. Cosmochim. Acta* **72**: A194 Suppl.
275. *Y. Duan, G. L. Arnold, G. W. Gordon and A. D. Anbar (2008). Evidence from Mo isotopic compositions for "A whiff of oxygen" before the Great Oxidation Event. *Geochim. Cosmochim. Acta* **72**: A228 Suppl.
276. J. Neuster, L. J. Liermann, L. E. Wasylenki, A. D. Anbar and S. L. Brantley (2008). Does Iron dissociation from siderophores lead to Iron isotope fractionation? *Geochim. Cosmochim. Acta* **72**: A692 Suppl.
277. C. Reinhard, R. Raiswell, A. Anbar and T. Lyons. (2008). Oxidative weathering and the Fe-S balance of the late Archean ocean. *Geochim. Cosmochim. Acta* **72**: A784 Suppl.
278. L. E. Wasylenki, C. L. Weeks, T. G. Spiro, J. R. Bargar and A. D. Anbar (2008). How does metal adsorption cause isotopes to apportion? *Geochim. Cosmochim. Acta* **72**: A1007 Suppl.
279. A. D. Anbar, A. J. Kaufman, G. Arnold, R. Buick, R. Creaser, Y. Duan, J. Farquhar, J. Garvin, D. Johnston, B. Kendall, T. W. Lyons and C. Scott (2008). A whiff of oxygen before the Great Oxidation Event. *Astrobiology* **8**: 319.
280. *J. B. Glass, F. Wolfe-Simon and A. D. Anbar (2008). The co-evolution of nitrogen and molybdenum biogeochemical cycles: Mo requirements for nitrogen assimilation in diazotrophic heterocystous cyanobacteria. *Astrobiology* **8**: 357.
281. H. Hartnett, K. Alexander, F. Garcia-Pichel and A. Anbar (2008). Production of dissolved organic carbon by desert biological soil crusts during simulated rainfall experiments. *Astrobiology* **8**: 428.
282. T. Lyons, W. Gilhooly, C. Reinhard, G. Love and A. Anbar (2008). The challenge of distinguishing between marine and nonmarine deposition on early Earth. *Astrobiology* **8**: 323.
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Invited Presentations/Colloquia

1. *Redox Revolutions: Earth and Beyond*. Jet Propulsion Laboratory, Caltech, January, 2021.
2. *Redox Revolutions: Earth and Beyond*. Institute Earth Sciences, Hebrew University, December, 2020.
3. *Redox Revolutions: Earth and Beyond*. Institute of Surface-Earth System Science, Tianjin University, November, 2020.
4. *Redox Revolutions: Earth and Beyond*. Department of Geological Sciences, University of North Carolina – Chapel Hill, August, 2020.

5. *Education Through Exploration: Reimagining Learning in a Digital Age*. Remote Summit, July, 2020.
6. *Redox Revolutions: Earth and Beyond*. Jackson School of Geosciences, University of Texas – Austin, February, 2020.
7. *Medical Metallomics: Can Calcium Isotopes Detect Cancer?* Department of Physics, University of Texas – Austin, February, 2020.
8. *Redox Revolutions*. Lunar and Planetary Laboratory, University of Arizona, October, 2019.
9. *Education Through Exploration: Reimagining Learning in a Digital Age*. Kiwanis Club of Tempe, September, 2018.
10. *Education Through Exploration: A New Model of Learning Design*. Learning Innovation Summit, NASA Ames Research Center, June, 2018.
11. *Education Through Exploration: Reimagining Learning in a Digital Age*. Pennsylvania State University, April, 2018 (B. Willard and Ruby S. Miller Lectureship in Geography).
12. *Education Through Exploration: Reimagining Learning in a Digital Age*. Rotary Club of Tempe, March, 2018.
13. *Life on Earth and Beyond: Past, Present, and Future*. Aerobics for the Mind, Gold Canyon, March, 2018.
14. *Elements and Evolution*. Gordon Research Conference on Metals in Biology, Ventura, CA, January, 2018.
15. *A New Teaching Approach: Education Through Exploration*. Learning Innovation Summit, Melbourne, Australia, July, 2017.
16. *Designing an Integrated Theory of Earth Evolution*. University of Washington seminar hosted by the NAI Virtual Planetary Lab, Seattle, WA, May, 2017.
17. *Education Through eXploration: Reimagining Learning in a Digital Age*. Oregon State University “Innovating Science Online” lecture, Corvallis, OR, March, 2017.
18. *Evolutionary Metallomics*. Pittcon, Chicago, March, 2017.
19. *Reimagining Education in a Digital Age*. AAC&U Annual Meeting, January, 2016.
20. *Reimagining Education in a Digital Age*. Keynote presentation, Grand Opening of the Center for Excellence in Teaching and Learning, Georgia State University, April, 2016.
21. *Life on Earth and Beyond: Past, Present, and Future*. New Discoveries lecture series, School of Earth & Space Exploration, Arizona State University, April, 2016.

22. *Redox Revolutions*. CIDER presentation, May 2016 (presentation cancelled due to conflict).
23. *Transdisciplinary Training through Technology*. EarthCube keynote, July, 2016.
24. *The Emergence of a Planetary Intelligence*. Coffee@Beyond Seminar, September, 2016.
25. *Redox Revolutions*. Dept. of Earth, Planetary, and Atmospheric Sciences, Massachusetts Institute of Technology, Cambridge, MA, April, 2016.
26. *Good Golly, It's Moly!* MSA Short Course on Nontraditional Stable Isotopes, Berkeley, CA, December, 2016.
27. *Improving Student Success with Digital Learning in Higher Education*. U.S. Education Learning Forum, Bill & Melinda Gates Foundation, October, 2015.
28. *Reimagining Science Education in the Digital Age: Education through Exploration*. DREAM 2015, February 2015.
29. *The Breath of Life: Oxygen in Earth's Atmosphere and the Search for Life Beyond*. Sigma Xi (ASU), October, 2015.
30. *Education Through Exploration*. Department of Earth Sciences, University of Toronto, Toronto, Canada, February, 2015.
31. *A Non-Traditional Application of Non-Traditional Isotopes: Can Calcium Isotopes Detect Cancer?* Department of Earth Sciences, University of Toronto, Toronto, Canada, February, 2015.
32. *Education Through Exploration*. Department of Geological Sciences, Indiana University, February, 2015.
33. *A Non-Traditional Application of Non-Traditional Isotopes: Can Calcium Isotopes Detect Cancer?* Department of Geological Sciences, Indiana University, February, 2015.
34. *Virtual Exploration of Earth's Evolution*. Spirit of the Senses (Phoenix community group), September, 2014.
35. *Detecting Exoplanetary Ecosystems*. Invited plenary talk at the 3rd International Geobiology Conference, Wuhan, China, June 2014.
36. *A Non-Traditional Application of Non-Traditional Isotopes: Can Calcium Isotopes Detect Cancer?* Chinese Academy of Geological Sciences, Beijing, June, 2014.
37. *A Non-Traditional Application of Non-Traditional Isotopes: Can Calcium Isotopes Detect Cancer?* University of Science and Technology of China, Hefei, June, 2014.
38. *The Uranium Isotope Paleoredox Proxy: A Primer and Future Prospects*. University of Science and Technology of China, Hefei, June, 2014.

39. *Are We Alone?* Invited presentation to the ASU Faculty Emeritii Association, April, 2014.
40. *Early Detection of Osteolytic Lesions in Multiple Myeloma using Natural Calcium Isotopes.* Dept. of Earth and Planetary Sciences, University of New Mexico, September, 2013.
41. *Astrobiology.* 100 Year Starship Symposium, September, 2013.
42. *A Whiff of Oxygen in the Anoxic Archean.* Astrobiology Lecture Series, Rensselaer Polytechnic Institute, May, 2013.
43. *Metallomic Markers in Medicine.* ASU Biodesign Program Presentation, April, 2013.
44. *ASU and OpenClass: Are We Alone? Teaching Science Through Exploration.* Cite 2013 Conference, Chicago, IL, April, 2013
45. *Metal Stable Isotopes as Environmental Source Tracers: Fe & Hg Isotope Case Studies.* Dept. of Soil, Water and Environmental Science, University of Arizona, March, 2013.
46. *Looking at Earth from a Different Perspective.* Tempe Chamber of Commerce Hot Topics and Lunch, Tempe, AZ, February, 2013. (<http://azscitechfest.org/node/1545>)
47. *The Great Poisoning: How Oxygen Transformed our Planet.* Beyond workshop on Oxygen and Cancer, Scottsdale, AZ, November, 2012.
48. *Astrobiology at ASU.* Tempe South Rotary Club, Tempe. AZ, November, 2012.
49. *Habitable Worlds: A HiFi Online Course.* Presentation with Adrian Sannier (Pearson) at EDUCAUSE, Denver, CO, October, 2012.
50. *Extracting Features of the History of Life on Earth from the Geologic Record.* Guest Lecture (video), Montana State University Astrobiology Course, October, 2012.
51. *Flipping to Avoid Flopping: Inverting the Lecture-Lab Paradigm.* Keynote presentation at Adaptive eLearning Forum, University of New South Wales, Sydney, Australia, July 2012.
52. *Calcium Isotope Biomarkers in Biomedicine and Human Space Exploration.* Dept. of Earth & Space Sciences, University of California – Los Angeles, May, 2012.
53. *Catalyzing Creative Connections.* Keynote presentation at Sustainability Symposium, School of Environmental Studies, The Hebrew University of Jerusalem, Israel, May, 2012.
54. *Driving Digital Disruption: How I learned to stop worrying and embrace online education.* Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel, May, 2012.
55. *Every Breath You Take: An Early Whiff of Oxygen on the Ancient Earth.* Interuniversity Institute for Marine Sciences, Eilat, Israel, April, 2012.

56. *Paleoredox Proxies: Molybdenum and Uranium Isotopes*. 4th Kaplan Symposium, Ein Gedi, Israel, March, 2012.
57. *A Whiff of Oxygen in the Anoxic Archean*. Dept. of Geological Sciences, Ben Gurion University, Beer-Sheba, Israel, March, 2012.
58. *A Whiff of Oxygen in the Anoxic Archean*. Dept. of Environmental Sciences, Weizmann Institute of Science, Rehovot, Israel, March, 2012.
59. *Calcium Isotope Biomarkers in Biomedicine and Human Space Exploration*. Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel, March, 2012.
60. *Oxygen Evolution: Scratching the Surface*. Keynote presentation at NERC Workshop on Volatiles and Fluids, Oxford, UK, February, 2012.
61. *Putting the “Geo” in Astrobiology*. Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel, February, 2012.
62. *A Whiff of Oxygen in the Anoxic Archean*. Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel, January, 2012.
63. *Origins of Life: Earth and Beyond*. ASU President’s Community Engagement Program, Scottsdale, AZ, February, 2011.
64. *An Early Whiff of Oxygen*. Origins Workshop, ASU Origins Project, Tempe, AZ, March, 2011.
65. *Calcium Isotopes in Biomedicine and Human Space Exploration*. School of Earth & Space Exploration Colloquium, Arizona State University, February, 2011.
66. *NASA, Astrobiology and Continental Scientific Drilling: The Astrobiology Drilling Program*. DOSECC Workshop, Washington, DC, May, 2011.
67. *Isotopic Inferences*. Guest Lecture (video), Montana State University Astrobiology Course, October, 2011.
68. *Follow the Elements: An Early Whiff of Oxygen?* Dept. of Geosciences, Lawrence Livermore National Laboratory, Livermore, CA, December, 2010.
69. *Follow the Elements: An Early Whiff of Oxygen?* Space Telescope Science Institute, Baltimore, MD, October, 2010.
70. *Follow the Elements: An Early Whiff of Oxygen?* Dept. of Geosciences, Pennsylvania State University, State College, PA, October, 2010.
71. *Nutrients and Trace Elements through Time*. NAI Anaerobic Photosynthetic Ecosystems Workshop, Fayetteville, NY, October, 2010.
72. *Follow the Water?* Scottsdale Museum of Contemporary Art, Scottsdale, AZ, September, 2010.

73. *Deep Time Drilling as a Window into Earth's Early History*. NSF Workshop, Carnegie Institute of Washington, Washington, DC, August, 2010.
74. *Drilling Deep Time: Windows into Earth's Early Biosphere*. NSF Headquarters, Washington, DC, July, 2010.
75. *The Early Breath of Life: Evidence of O₂ in the Late Archean Eon*. Australian Centre for Astrobiology, University of New South Wales, Sydney, Australia, April, 2010.
76. *Photosynthesis and the rise of O₂: constraints from the geologic record*. 19th Western Photosynthesis Conference, Pacific Grove, CA, January, 2010.
77. *Searching for Life at ASU*. Spirit of the Senses (Phoenix community group). October, 2009.
78. *Follow the Elements: Astrobiology at ASU*. Canada Institute for Advanced Research (CIFAR) workshop on astrobiology, Toronto, Canada, April, 2009.
79. *Follow the Elements: Astrobiology at ASU*. NASA Astrobiology Institute Team Overview Seminar, Videocon broadcast, March, 2009.
<http://nai.arc.nasa.gov/library/uploads/AB090316.mov>
80. *Elements and Evolution*. School of Life Sciences Seminar Series, Arizona State University, Tempe, AZ, April, 2009.
81. *Follow the Elements: Astrobiology at ASU*. School of Earth & Space Exploration Colloquium, Tempe, AZ, January, 2009.
82. *Science & Technology Education: The University of Tomorrow?* Presentation to the American Technion Society, September, 2008.
83. *The Origin of the Earth*. Temple Emmanuel (Tempe) Science & Religion Event, May, 2008.
84. *Alternative Earths*. Presentation in the *Final Word* symposium series, ASU Kerr Cultural Center, February, 2008.
85. *Alternative Earths*. Presentation to the Humanist Society of Greater Phoenix, February, 2008.
86. *Life in the Universe: Lessons from a Dead World*. Invited presentation to the ASX Symposium "Expanding Canada's Frontiers: Lunar Exploration", Toronto, Canada, January, 2008.
87. *A Whiff of Oxygen before the Great Oxidation Event?* Department of Geological Sciences, University of Toronto, Toronto, Canada, January, 2008.
88. *A Whiff of Oxygen before the Great Oxidation Event?* NASA Astrobiology Institute Director's Seminar Series, Videocon broadcast, November, 2007.
http://nai.arc.nasa.gov/seminars/seminar_detail.cfm?ID=112

89. *A Whiff of Oxygen before the Great Oxidation Event?* Astrobiology Seminar Series, University of Arizona, Tucson, AZ, November, 2007.
90. *Evidence for a Whiff of Oxygen before the Paleoproterozoic Great Oxidation Event.* Department of Geological Sciences, University of Michigan, Ann Arbor, MI, October, 2007.
91. *A Whiff of Oxygen before the Great Oxidation Event?* NASA Astrobiology Institute Biosignatures Workshop, Sudbury, ON, Canada, September, 2007.
92. *An Early Whiff of Oxygen and a Late Stench of Sulfide?* Department of Earth & Space Sciences, University of California, Los Angeles, May, 2007.
93. *Insights into Ocean Redox Evolution from Metals and Metal Isotopes.* Department of Geology, University of Texas, El Paso, TX, April, 2007.
94. *A Whiff of Oxygen before the Great Oxidation Event?* Department of Geoscience, University of Nevada, Las Vegas, NV, March, 2007.
95. *A Whiff of Oxygen at the Archean-Proterozoic Boundary.* School of Earth & Space Exploration Colloquium, Tempe, AZ, February, 2007.
96. *A Whiff of Oxygen at the Archean-Proterozoic Boundary.* Department of Atmospheric and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA, January, 2007.
97. *A Whiff of Oxygen before the Great Oxidation Event.* Department of Geosciences, Virginia Polytechnic Institute and State University, Blacksburg, VA, January, 2007.
98. *Alternative Life: Let's Get Elemental!* Alternative Life Workshop, ASU, December, 2006.
99. *Redox Revelations: An Early Whiff of Oxygen and a Late Stench of Sulfide?* Department of Geological and Environmental Sciences, Stanford, November, 2006.
100. *Alternative Earths.* Astrobiology Lecture Series, New Mexico Institute of Technology, October, 2006.
101. *Oxygenation of the Surface Ocean at the Archean-Proterozoic Boundary.* Astrobiology Class Lecture, New Mexico Institute of Technology, October, 2006.
102. *Drilling in Western Australia: Progress and Prospects.* Agouron Foundation Drilling Workshop, Pasadena, CA, October, 2006.
103. *The Earth through Time: The Earth's Coevolution with the Biosphere.* Pale Blue Dot III, Chicago, IL, September, 2006.
104. *The Evolution of the Earth.* Spirit of the Senses (Phoenix community group), September, 2006.
105. *Follow the Elements!* Gordon Research Conference on the Origin of Life, Lewiston, ME. July, 2006.

106. *“Non-traditional” Isotopic Biosignatures*. NRC Biosignature Workshop, Washington, DC, May, 2006.
107. *The Rise of Oxygen and the Evolution of the Metallome*. Agouron Foundation O2 Workshop, Santa Fe, NM, April, 2006.
108. *Hot Night in the City? The Present, Past and Future of Earth’s Climate System*. The Last Lecture Series, Arizona State University, Tempe, AZ, April, 2006.
109. *Insights into Ocean Redox Evolution from Metals and Metal Isotopes*. Scripps Institute of Oceanography, March 2006.
110. *Molybdenum Isotopes as Paleoredox Proxies*. NSF Workshop on Paleoproxies, San Francisco, CA December, 2005.
111. *Good Golly, It’s Moly! Insights into the Evolution of Life and Environment from Molybdenum, Mass Spectrometry and Metallomics*. Department of Chemistry, Northern Arizona University. October, 2005.
112. *Transition Metal Stable Isotopes*. 1st I. R. Kaplan Workshop: New Developments in Environmental Isotope Research, Hagoshrim, Israel. September, 2005.
113. *Insights into Redox Evolution of the Oceans from Molybdenum and Iron Isotopes*. 1st I. R. Kaplan Workshop: New Developments in Environmental Isotope Research, Hagoshrim, Israel, September, 2005.
114. *Environmental Geochemistry of Novel Stable Isotopes: Systematics, Surprises and Solutions*. Environmental Bioinorganic Chemistry Group, Princeton University, April, 2005.
115. *Good Golly, It’s Moly! Insights into the Evolution of Life and Environment from Molybdenum, Mass Spectrometry and Metallomics*. Department of Chemistry, Bryn Mawr College. April, 2005.
116. *Testimony before the President’s Commission on Implementation of U.S. Space Exploration Policy*. Public Hearing, May, 2004.
117. *Molybdenum Stable Isotopes: Observation, Interpretations and Directions*. MSA Short Course on the Geochemistry of Non-traditional Stable Isotopes, Montreal, Canada, May, 2004.
118. *Microbes and Metal Isotopes: Building a Bioinorganic Bridge*. Gordon Research Conference on Environmental Bioinorganic Chemistry, Bates College, NH, July, 2004.
119. *Good Golly, It’s Moly! Insights into Ocean Chemistry and Evolution from Molybdenum and its Isotopes*. Department of Earth and Space Sciences, University of Washington. October, 2003.
120. *Good Golly, It’s Moly! Insights into Ocean Chemistry and Evolution from Molybdenum and its Isotopes*. Agouron-Wrigley-USC Geobiology Summer Course, the Wrigley-USC Institute for Environmental Studies, Catalina Island, CA July, 2003.

121. *Molybdenum Isotopes in Biology and the Environment*. Gordon Research Conference on Molybdenum and Tungsten Enzymes, Meridan, NH. June, 2003.
122. *Good Golly, It's Moly! Insights into Ocean Chemistry and Evolution from Molybdenum and its Isotopes*. Department of Geophysical Sciences, University of Chicago. June, 2003.
123. *Microbes and Metal Isotopes: Building a Bioinorganic Bridge*. Department of Geology, Arizona State University. May, 2003.
124. *Good Golly, It's Moly! Insights into Ocean Chemistry and Evolution from Molybdenum and its Isotopes*. Department of Geosciences, Princeton University. March, 2003.
125. *Good Golly, It's Moly! Insights into Ocean Chemistry and Evolution from Molybdenum and its Isotopes*. Department of Earth and Atmospheric Sciences. Cornell University. March, 2003.
126. *Good Golly, It's Moly! Insights into Ocean Chemistry and Evolution from Molybdenum and its Isotopes*. Department of Geology, Arizona State University. February, 2003.
127. *Good Golly, It's Moly! Insights into Ocean Chemistry and Evolution from Molybdenum and its Isotopes*. USGS- Menlo Park. February, 2003.
128. *Stable Isotope Geochemistry of Transition Metals: Methods, Mechanisms and the need for Models*. Department of Geosciences, Princeton University. December, 2002.
129. *In Pursuit of Proterozoic Paleoredox: Insight from Molybdenum Isotopes*. Center for Astrobiology, University of Colorado (Boulder). October, 2002.
130. *Proterozoic Ocean Chemistry and Evolution: A Bioinorganic Bridge?* Department of Chemistry, University of Cincinnati. October, 2002.
131. *Molybdenum Isotopes: In Pursuit of Proterozoic Paleoredox*. New York Center for Studies on the Origins of Life, Rensselaer Polytechnic Institute. September, 2002.
132. *Ocean Chemistry & Evolution: Insight from Molybdenum and its Isotopes*. Dept. of Chemistry, University of Rochester. September, 2002.
133. *Molybdenum Isotopes: In Pursuit of Proterozoic Paleoredox*. Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology. April, 2002.
134. *Novel Isotopic Biosignatures: Promise and Progress*. NAI Director's Seminar Series Webcast. March, 2002.
135. *Novel Isotopic Biosignatures: Promise and Progress*. Gordon Research Conference on the Origin of Life, Ventura, CA January, 2002.
136. *Earth, Mars and Beyond: The Search for Life in Difficult Places*. Kodak Research & Engineering Retirees Organization, Rochester, NY. January, 2002.

137. *Iron Isotopes and the Search for Life on Mars*. Department of Chemistry, Alfred College, October, 2001.
138. *Iron Isotopes and the Search for Life on Mars*. Department of Chemistry, SUNY Brockport. September, 2001.
139. *Earth, Mars and Beyond: The Search for Life in Difficult Places*. University of Rochester Alumni Association. September, 2001.
140. *Transition Metal Isotope Fractionation: Promise and Progress*. Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology. September, 2001.
141. *Transition Metal Isotope Fractionation: Promise and Progress*. Gordon Research Conference on Chemical Oceanography, Tilton, NH. August, 2001.
142. *Mission to Early Earth: Overview*. 2001 Meeting of the NASA Astrobiology Institute, Carnegie Institution of Washington. April, 2001.
143. *Iron Isotopes and the Search for Life on Mars: Promise and Progress*. Department of Geology and Geophysics, University of Minnesota. March, 2001.
144. *Molybdenum Isotopes: Potential Paleoredox Probes?* Department of Geology and Geophysics, University of Minnesota. March, 2001.
145. *Iron Isotopes and the Search for Life on Mars: Promise and Progress*. Department of Geological Sciences, University of Missouri. January, 2001.
146. *Iron Isotopes and the Search for Life on Mars: Promise and Progress*. Department of Geology, Arizona State University. October, 2000.
147. *Iron Isotopes and the Search for Life on Mars: Promise and Progress*. Department of Earth Sciences, Syracuse University. September, 2000.
148. *Iron Isotopes and the Search for Life on Mars*. Department of Chemistry, SUNY Geneseo. September, 2000.
149. *Iron Isotopes: Promise and Progress*. Department of Geophysical Sciences, University of Chicago. May, 2000.
150. *Iron Isotopes: Biomarker Prospects*. NRC Workshop on Life Detection (Committee on the Origin and Evolution of Life of the NAS Space Studies Board and Board on Biology), Carnegie Institution of Washington. April, 2000.
151. *Fractionations of Transition Metal Stable Isotopes: Promise and Progress*. Geochemical Perspectives on Environmental Processes – 2000, Washington University. April 2000.

152. *Stable Isotope Geochemistry of Transition Metals: Iron Isotope Inferences*. Department of Geological Sciences, Cornell University. March, 2000.
153. *Stable Isotope Geochemistry of Transition Metals: Iron Isotope Inferences*. Department of Geosciences, Pennsylvania State University. March, 2000.
154. *The Search for Life: Inferences from Iron Isotopes?* Dept. of Physics, University of Rochester. January, 2000.
155. *Stable Isotope Geochemistry of Transition Metals: Iron Isotope Inferences*. Division of Geological and Planetary Sciences, California Institute of Technology. December, 1999.
156. *Life in the Geologic Record: Inferences from Iron Isotopes?* Department of Geology and Geophysics, Yale University. October, 1999.
157. *The Search for Life in Far-off Places*. Laboratory for Laser Energetics, University of Rochester. September, 1999.
158. *The Extraterrestrial Mass Flux on the Early Earth: Implications for Life*. Department of Geology and Geophysics, Yale University. April, 1999.
159. *Determination of Cu and Mo Isotope Fractionations Using MC-ICP-MS (poster w/J. Barling and J. E. Roe)*. Gordon Research Conference on Chemical Oceanography, Barga, Italy. May, 1998.
160. *Trace Element Frontiers*. Dept. of Earth and Atmospheric Sciences, University of Alberta. January, 1998.
161. *Fractionation of transition metal stable isotopes: A new approach for the study of life in the geologic record (poster w/J. Barling, J. E. Roe, K. A. Knab and K. Nealson)*. Gordon Research Conference on the Origin of Life, Ventura, CA February, 1999.
162. *The Environmental Chemistry of Iridium: Providing Perspective on Dinosaur Doom*. Department of Chemistry, Canisius College. February, 1997.
163. *Trace Element Frontiers*. Dept. of Earth and Planetary Sciences, Harvard University. December, 1996.
164. *The Environmental Chemistry of Iridium: Providing Perspective on Dinosaur Doom*. Meeting of the W. New York Section of the American Chemical Society. November, 1996.
165. *Iridium in Natural Waters*. Dept. of Geology, Woods Hole Oceanographic Institution. August, 1996.
166. *Iridium in Natural Waters*. Dept. of Earth and Planetary Sciences, Harvard University. May, 1996.
167. *Iridium in Natural Waters*. Dartmouth College, Department of Earth Sciences. May, 1996.

168. *The Photochemistry of Manganese and the Origin of Banded Iron Formations* (poster w/H. D. Holland) Gordon Research Conference on the Origins of Life, Concord, NH. August, 1990.

Funding History

Active Awards:

Source of Support: NSF

Principal Investigator: A. D. Anbar

Co-Investigators: W. Zheng (now at Tianjin University, China, so technically not a Co-PI)

Project Title: Mercury Stable Isotopes as a Proxy of Photic Zone Euxinia

Award Amount: \$420,380

Period of Award: 6/1/20 – 5/31/23

Source of Support: NASA ICAR

Principal Investigator: Betül Kaçar (U. Arizona)

Co-Investigators: A. D. Anbar (Deputy PI) and multiple other Co-Is

Project Title: What Life wants: Exploring the Natural Selection of Elements

Award Amount: \$1,782,724 to ASU

Period of Award: 10/31/20 – 9/30/25

Source of Support: NSF

Principal Investigator: K. Borner (Indiana University)

Project Title: Analytics-Driven Accessible Pathways To Impacts-Validated Education (ADAPTIVE)

Award Amount: \$200,000 to ASU

Period of Award: 9/1/19 – 5/31/21

Source of Support: Dept. of Education

Principal Investigator: A. D. Anbar

Project Title: Consortium for Open Active Pathways

Award Amount: \$2,500,000

Period of Award: 3/1/19 – 2/28/22

Source of Support: Future Investigators in NASA Earth and Space Science and Technology

Principal Investigator: A. D. Anbar (with D. Sullivan, graduate student)

Project Title: NESSF: Bridging the O₂ Gap: Using Rhenium Isotopes to Detect Low O₂ in Ancient Oceans

Award Amount: \$120,000

Period of Award: 9/1/20 – 8/31/23

Source of Support: NASA SMD

Principal Investigator: A. D. Anbar (originally L. Elkins-Tanton)

Co-Investigators: S. Semken and other SESE faculty

Project Title: NASA SMD Exploration Connection (the Infiniscope Project)

Award Amount: \$10,183,479 (2/1/16 – 1/31/21); \$10,780,742 (2/1/21 – 1/31/26)

Period of Award: 2/1/16 – 1/31/26

Source of Support: NASA SMD
Principal Investigator: M. Wadhwa
Co-Investigators: A. Anbar and other SESE faculty
Project Title: NASA SMD Community of Practice for Education (SCoPE)
Award Amount:
Period of Award: 2/1/16 – 1/31/26

Source of Support: Howard Hughes Medical Institute
Principal Investigator: A. D. Anbar
Co-Investigators: None
Project Title: Virtual Exploration of Earth's Evolution
Award Amount: \$1,000,000
Period of Award: 9/1/14 – 8/31/21

Source of Support: Howard Hughes Medical Institute
Principal Investigator: J. Collins (ASU)
Co-Investigators: A. D. Anbar, S. Brownell
Project Title: Teaching transformed: Using education technology to create a culture of inclusive excellence
Award Amount: \$1,000,000
Period of Award: 9/1/18 – 8/31/23

Pending Awards:

Expired Awards:

Source of Support: NASA - Earth and Space Science Fellowship
Principal Investigator: A. D. Anbar (with A. Johnson, graduate student)
Project Title: NESSF: How low can we go? Measuring Archean weathering rates in ultra low-O₂ experiments
Award Amount: \$120,000
Period of Award: 9/1/17 – 8/31/20

Source of Support: NSF (Frontiers in Earth System Dynamics Program)
Principal Investigator: A. D. Anbar
Project Title: FESD Type I: Dynamics of Earth System Oxygenation
Award Amount: \$4,845,000
Period of Award: 9/01/13 – 8/31/20

Source of Support: NASA Astrobiology Program
Principal Investigator: T. W. Lyons (UC Riverside)
Project Title: Alternative Earths: Explaining Persistent Inhabitation on a Dynamic Early Earth
Award Amount: \$448,157 to ASU
Period of Award: 4/16/15 – 12/31/20

Source of Support: NASA Astrobiology Program

Principal Investigator: S. Desch (ASU)
Project Title: Exoplanetary Ecosystems: Exploring Life's Detectability on Chemically Diverse Exoplanets
Award Amount: \$6,097,436
Period of Award: 12/31/14 – 12/30/20

Source of Support: Alfred P. Sloan Foundation
Principal Investigator: D. Sarewitz (ASU)
Project Title: Exploring Democratic Governance of Geoengineering Research Through Public and Stakeholder Engagement
Award Amount: \$299,680
Period of Award: 11/01/17 – 4/30/19

Source of Support: NSF DUE
Principal Investigator: A. D. Anbar (ASU)
Co-Principal Investigators: S. Semken (ASU)
Project Title: Exploration-Driven Online Science Education: Habitable Worlds 2.0
Request Amount: \$679,178 (includes original award and \$80,100 supplement)
Period of Request: 1/1/13 – 8/30/19

Source of Support: Bill & Melinda Gates Foundation
Principal Investigator: A. D. Anbar (ASU)
Co-Investigators: D. Ben-Naim (ASU and Smart Sparrow, LLC); G. Siemens (UT – Arlington)
Project Title: The Inspark Science Network
Award Amount: \$470,000 to ASU (of \$4.5 million total award)
Period of Award: 9/1/15 – 8/31/18

Source of Support: NASA (Human Research Program)
Principal Investigator: A. D. Anbar (ASU)
Co-Investigators: G. Gordon, J. Skulan (ASU)
Project Title: Stable calcium isotopes in urine as a biomarker of bone mineral balance in spaceflight
Award Amount: \$550,000
Period of Award: 12/01/13 – 11/30/17

Source of Support: NASA (Exobiology Program)
Principal Investigator: A. D. Anbar (ASU)
Co-Investigators: A. Herrmann (LSU); T. Algeo (U. Cincinnati)
Project Title: Uranium Isotope Variations in Carbonates: Validating A New Paleoredox Proxy
Award Amount: \$619,292
Period of Award: 9/1/2013 – 8/31/17

Source of Support: Flinn Foundation
Principal Investigator: A. D. Anbar (ASU); K. Cannon (Mayo Clinic)
Project Title: Improving the clinical utility of Ca isotope analysis by assessing population level variation in the Ca isotope composition of blood
Award Amount: \$100,000
Period of Award: 9/01/13 – 8/31/16

Source of Support: NSF OCE
Principal Investigator: A. Herrmann (LSU)
Principal Investigator: Lisa Levin (UCSD)
Co-Principal Investigators: A. D. Anbar and G. Gordon (ASU)
Project Title: Ocean Acidification Category 2: Collaborative Research - Development of geochemical proxies to evaluate larval pH-exposure history
Award Amount: \$99,633 to ASU
Period of Award: 6/1/11 – 5/31/14

Source of Support: NSF EAR
Principal Investigator: A. Herrmann (ASU)
Co-Principal Investigators: A. Anbar (ASU)
Principal Investigators: T. Algeo (U. Cinn.), J. Barrick (U. Texas), B. Haupt (PSU)
Project Title: COLLABORATIVE RESEARCH: Integrated Paleooceanographic Analysis of the Late Paleozoic Midcontinent Sea
Award Amount: \$78,000 to ASU (award to date; not yet fully funded)
Period of Award: 6/1/11 – 5/31/14

Source of Support: NSF OCE
Principal Investigator: A. Herrmann
Co-Principal Investigators: A. D. Anbar, L. E. Wasylenki (now at U. Indiana)
Project Title: Uranium isotopes in carbonate sediments: Assessing a novel paleoredox proxy
Award Amount: \$368,544
Period of Award: 6/1/10 – 5/31/14

Source of Support: NSF AGS
Principal Investigator: B. Majestic (NAU; now Denver University) *LEAD INSTITUTION*
Principal Investigator: P. Herckes (ASU)
Co-Principal Investigator: A. D. Anbar (ASU)
Project Title: Collaborative Research: Atmospheric processing of iron - does particle size influence iron solubility?
Award Amount: \$220,238 to ASU
Period of Award: 5/1/10 – 4/30/14

Source of Support: NASA
Principal Investigator: S. Semken
Co-Investigators: A. D. Anbar, W. Burelson, K. Hodges, W. Taylor
Project Title: NASA Triad: A Triangulated Program to Promote NASA Stem Education Nationwide
Award Amount: \$733,743
Period of Award: 9/1/10 – 8/31/14

Source of Support: NASA Astrobiology Program
Principal Investigator: A. D. Anbar (ASU)
Co-Investigators: S. Desch, J. Elser, J. Farmer, B. Grigsby, K. Hodges, S. Neuer, S. Semken, E. Shock, F. Timmes, M. Wadhwa, M. Zolotov (all at ASU); T. Lyons (UC Riverside); J. Raymond (UC Merced); J. Siefert (Rice)

Project Title: Follow the Elements: A proposal for membership in the NASA Astrobiology Institute

Award Amount: \$6,506,153

Period of Award: 1/01/09 – 12/31/14

Source of Support: NSF OCE

Principal Investigator: A. D. Anbar (ASU) *LEAD INSTITUTION*

Principal Investigator: B. Majestic (NAU; now Denver University)

Co-Principal Investigator: P. Herckes (ASU)

Project Title: Collaborative Research: Source apportionment of iron in the marine atmosphere - application of stable iron isotopic measurements

Award Amount: \$225,202 to ASU

Period of Award: 10/1/10 – 09/30/12

Source of Support: NSF MRI

Principal Investigator: P. Williams

Co-Principal Investigators: A. D. Anbar, J. Anderson, J. Elser, R. Hervig, E. Shock, M. Wadhwa, W. Vermaas

Project Title: Acquisition Of A Nanosims 50L Imaging Secondary Ion Mass Spectrometer

Award Amount: \$3,267,586

Period of Award: 2010 – 2012

Source of Support: NSF EAR (Sedimentary Geology and Paleobiology)

Principal Investigator: A. D. Anbar (ASU)

Principal Investigator: G. Jiang (UNLV) *LEAD INSTITUTION*

Principal Investigator: T. Lyons (UC Riverside)

Principal Investigator: S. Xiao (VA Tech)

Project Title: Collaborative Research: Ocean Redox Evolution at the Dawn of Animal Life: An Integrated Geological and Geochemical Study of the Ediacaran Yangtze Platform in South China

Award Amount: \$97,209 to ASU

Period of Award: 8/01/08 – 7/31/12

Source of Support: ASU-Mayo Pilot Funding

ASU Investigator #1: A. D. Anbar

ASU Investigator #2: G. W. Gordon

Mayo Investigator #1: R. Fonseca

Project Title: Calcium isotopes: Inorganic Signatures of Multiple Myeloma Progression

Award Amount: \$40,000

Period of Award: 7/01/12 – 6/30/13

Source of Support: NSF EAR

Principal Investigator: A. D. Anbar (ASU) *LEAD INSTITUTION*

Principal Investigator: T. W. Lyons (UCR)

Co-Principal Investigator: B. Kendall (ASU)

Project Title: Collaborative Research: Examining the evolution of biospheric oxygenation in Late Archean to Middle Proterozoic oceans through high-resolution trace metal chemostratigraphy

Award Amount: \$142,143 to ASU

Period of Award: 7/1/10 – 6/30/12

Source of Support: NASA Astrobiology (Exobiology & Evolutionary Biology)

Principal Investigator: A. D. Anbar (ASU)

Collaborator: T. Lyons (UC Riverside)

Project Title: In search of early oxygen: Investigation of redox sensitive metal abundances and isotopes in Neoproterozoic drill cores

Award Amount: \$560,428

Period of Award: 10/01/07 – 9/30/12

Source of Support: NASA Human Research Program

Principal Investigator: A. D. Anbar (ASU)

Collaborators: J. Skulan (U. Wisconsin); S. Smith (JSC); T. D. Bullen (USGS)

Project Title: Rapid measurements of bone loss using tracer-less calcium isotope analysis of blood and urine

Award Amount: \$1,096,853

Period of Award: 7/01/08 – 6/30/12

Source of Support: NSF OCE (Chemical Oceanography)

Principal Investigator: A. D. Anbar (ASU) *LEAD INSTITUTION*

Co-Principal Investigator: L. E. Wasylenki (ASU)

Principal Investigator: Thomas Spiro (U. Washington)

Project Title: Collaborative Research: Systematics of Zn Isotopes in the Oceans: Assessing the Roles of Surfaces and Speciation

Award Amount: \$458,912 to ASU; \$112,784 to U. Washington

Period of Award: 9/01/08 – 8/31/11

Source of Support: NSF EAR (Sedimentary Geology and Paleobiology)

Principal Investigator: T. Algeo (U. Cincinnati) *LEAD INSTITUTION*

Co-Principal Investigator: A. D. Anbar (ASU)

Co-Principal Investigator: R. A. Creaser (U. Alberta)

Co-Principal Investigator: L. Schwark (U. Cologne)

Co-Principal Investigator: P. Sauer (U. Indiana)

Project Title: Middle and Upper Devonian Black Shales: Testing the Productivity-Anoxia Feedback and Land Plant-Weathering Rate Hypotheses

Award Amount: ~\$20,000 to ASU (subcontract)

Period of Award: 9/01/06 – 8/31/10

Source of Support: Dreyfus Foundation (Environmental Postdoc Program)

Principal Investigator: A. D. Anbar (ASU)

Co-Investigator #1: H. Hartnett (ASU)

Co-Investigator #2: P. Herckes (ASU)

Co-Investigator #3: E. Shock (ASU)

Project Title: Mass Dependent Isotope Fractionation of Bioessential and Toxic Metals: A New Perspective on the Environmental Chemistry of Metals

Award Amount: \$120,000

Period of Award: Two+ year fellowship; began 10/2007; no cost extension through 12/10

Source of Support: NSF EAR (Instrumentation & Facilities)

Principal Investigator: A. D. Anbar (ASU)
Co-Principal Investigator: N. Grimm (ASU)
Co-Principal Investigator: L. Leshin (ASU)
Co-Principal Investigator: E. Shock (ASU)
Project Title: Technician Support: ICP-MS Research in the W. M. Keck Foundation Laboratory for Environmental Biogeochemistry
Award Amount: \$224,996
Period of Award: 9/01/05 – 9/31/08 (now in second one year no-cost extension)

Source of Support: NSF EAR (Low-Temperature Geochemistry and Geobiology)
Principal Investigator: A. D. Anbar (ASU) *LEAD INSTITUTION*
Co-Principal Investigator: L. Wasylenki (ASU)
Co-Principal Investigator: S. L. Brantley (PSU)
Project Title: COLLABORATIVE RESEARCH: Investigation of Fe and Mo Isotope Fractionation During Weathering
Award Amount: \$299,621 (\$301,690 to PSU)
Period of Award: 9/01/05 – 9/31/09

Source of Support: NSF OCE (Chemical Oceanography)
Principal Investigator: A. D. Anbar (ASU) *LEAD INSTITUTION*
Co-Principal Investigator: L. Wasylenki (ASU)
Co-Principal Investigator: T. Spiro (Princeton)
Project Title: COLLABORATIVE RESEARCH: Transition Metal Isotope Fractionation During Adsorption to Authigenic Oxides
Award Amount: \$300,074 to ASU (\$150,003 to Princeton)
Period of Award: 9/01/05 – 9/31/09

Source of Support: NSF EAR (Biogeosciences)
Principal Investigator: H. Hartnett (ASU)
Co-Principal Investigator: A. D. Anbar (ASU)
Co-Principal Investigator: F. Garcia-Pichel (ASU)
Project Title: Biogeochemistry of Desert Crust Communities: Organic Carbon and Trace Metal Dynamics
Award Amount: \$389,331
Period of Award: 7/01/05 – 6/30/09

Source of Support: NSF EAR (Low-Temperature Geochemistry and Geobiology)
Principal Investigator: A. D. Anbar (ASU)
Principal Investigator: T. Lyons (UC Riverside) *LEAD INSTITUTION*
Project Title: Collaborative Research: A Comparative Geochemical Study of the Late Cambrian (SPICE) and Toarcian (Jurassic) Positive Carbon Isotope Excursions as a Window to Paleozoic Oceanic Anoxic Events
Award Amount: \$74,517 to ASU
Period of Award: 9/01/07 – 8/31/09

Source of Support: NASA Astrobiology Institute
Principal Investigator: A. D. Anbar (ASU)
Project Title: Proposal for Curation of ADP Drill Cores

Award Amount: \$212,954 + \$30,000 supplement
Period of Award: 01/05 – 12/31/09

Source of Support: Agouron Foundation
Principal Investigator: A. D. Anbar (ASU)
Project Title: The Rise of Oxygen and the Evolution of the Metallome
Award Amount: \$100,000
Period of Award: 3/01/07

Source of Support: NSF OCE (Marine Geology and Geophysics)
Principal Investigator: A. D. Anbar (ASU)
Principal Investigator: S. Severmann (UC Riverside) *LEAD INSTITUTION*
Principal Investigator: J. McManus (Oregon State University)
Project Title: Collaborative Research (UCR, OSU and ASU): Combined Fe-S stable isotopes in modern anoxic environments and the effect of Fe versus S limitation
Award Amount: \$38,422 to ASU
Period of Award: 3/01/06 – 2/29/08 (now in one year no-cost extension)

Source of Support: ASU-Mayo Pilot Funding
ASU Investigator #1: A. D. Anbar
ASU Investigator #2: G. Gordon
Mayo Investigator #1: Larry Miller
Mayo Investigator #2: Patricia Carrigan
Project Title: Environmental Factors and Pancreatic Cancer
Award Amount: \$40,000
Period of Award: 9/01/05 – 9/31/06

Source of Support: NSF (Geology & Paleontology)
Principal Investigator: A. D. Anbar (ASU) *LEAD INSTITUTION*
Project Title: COLLABORATIVE RESEARCH: Presaging Paleoproterozoic Global Change: Geobiology of the Late Archean Eon
Award Amount: \$74,624 to ASU (\$425,000 to MIT, Harvard, Missouri, Maryland, Harvard)
Period of Award: 9/15/04 – 9/14/06

Source of Support: NASA (Exobiology)
Principal Investigator: A. D. Anbar (ASU)
Co-Investigator #1: J. Barling (formerly at UR)
Co-Investigator #2: T. W. Lyons (U. Missouri)
Project Title: Mechanisms of Mo Isotope Fractionation: Assessing a New Tool for the Study of Ancient Ocean Redox
Award Amount: \$363,617
Period of Award: 5/03 – 4/06

Source of Support: NSF- EAR (Geology & Paleontology)
Principal Investigator: A. D. Anbar (ASU) *LEAD INSTITUTION*
Principal Investigator: T. W. Lyons (U. Missouri)
Co-Principal Investigator: J. Barling (formerly at UR)
Project Title: Collaborative Proposal: Molybdenum Isotopes as Paleoredox Proxies

Award Amount: \$224,918 to Rochester (\$74,544 to Missouri)
Period of Award: 1/03 – 12/06 (incl. one year no-cost extension)

Source of Support: Astrobiology Science & Technology
Principal Investigator: A. D. Anbar (ASU)
Project Title: Upgrade of MC-ICP-MS Instrumentation
Award Amount: \$210,000
Period of Award: 9/04 – 8/06 (incl. one year no-cost extension)

Source of Support: NSF- Academic Research Infrastructure
Principal Investigator: A. Basu (UR)
Co-Principal Investigator(s): A. D. Anbar, R. Poreda (UR)
Project Title: Request for a Technical Associate to Support the Isotope Geochemistry Laboratories at the University of Rochester
Award Amount: \$150,000 (original grant); ~ \$150,000 (renewal)
Period of Award: Original award: 3/98 - 2/02; Renewal + extension: 2/02 – 1/05

Source of Support: NASA Astrobiology Institute
Principal Investigator: Andrew Knoll (Harvard)
Co-Investigator(s): A. D. Anbar (UR) and researchers at Harvard, MIT & Smithsonian
Project Title: The Planetary Context of Biological Evolution
Award Amount: ~\$350,000 total to Rochester
Period of Award: 5 years + extension (7/98 – 10/04)

Source of Support: NASA Astrobiology Institute
Principal Investigator: Kenneth Nealson (JPL/Caltech)
Co-Investigator(s): A. D. Anbar (UR) and groups at Caltech/JPL, USGS and U. Wisc.
Project Title: Coevolution of Planets and Biospheres: Lessons from Earth and Mars
Award Amount: ~\$250,000 total to Rochester
Award Award: 5 years + extension (7/98 – 10/04)

Source of Support: UR-NIEHS Center for Environmental Health Sciences
Investigators: A. D. Anbar and E. Puzas (UR); J. Skulan (U. Wisconsin)
Project Title: Pilot Project: Ca Isotopes and Osteotoxicology
Award Amount: \$23,110
Period of Award: 9/02 – 3/04

Source of Support: Rochester Gas and Electric Co.
Principal Investigator: A. D. Anbar (UR)
Co-Investigator(s): R. J. Poreda (UR)
Project Title: Determination of Tc-99 in Aqueous and Soil Samples by ICP-MS
Award Amount: \$71,041
Period of Award: Expired in 2004

Source of Support: NSF- EAR (Geology & Paleontology)
Principal Investigator: A. D. Anbar (UR) *LEAD INSTITUTION*
Principal Investigator: S. L. Brantley (Penn. State)
Project Title: Collaborative Research: Iron & Molybdenum Isotope Fractionation during

Mineral Weathering

Award Amount: \$100,000 to Rochester

Period of Award: 24 months (5/01 - 4/04; includes one year no-cost extension)

Source of Support: NSF- EAR (Geology & Paleontology)

Principal Investigator: J. Barling (UR)

Co-Principal Investigator: A. D. Anbar

Project Title: Molybdenum Isotopes in the Geologic Record: Paleoredox Proxies?

Award Amount: \$100,000

Period of Award: 12 months (8/01 - 7/02; no cost extension to 7/03)

Source of Support: NSF- Life in Extreme Environments (LExEn)

Principal Investigator: A. D. Anbar (UR) *LEAD INSTITUTION*

Co-Principal Investigator: Kenneth Nealson (JPL/Caltech)

Project Title: Biogenic Fractionations of Transition Metal Isotopes: Novel Methods for the Examination of Life in Extreme Environments

Award Amount: \$270,000

Period of Award: 36 months (10/97 - 9/00)

Source of Support: NSF- Academic Research Infrastructure

Principal Investigator: A. D. Anbar (UR)

Co-Principal Investigator(s): A. Basu, R. Poreda, J. Tarduno, U. Fehn (UR)

Project Title: Acquisition of a High-Resolution Inductively-Coupled Plasma Mass Spectrometer for Research in Trace Element Geochemistry & Biogeochemistry

Award Amount: \$294,772 + \$50,000 supplement

Period of Award: 24 months (7/96 - 6/98)

Source of Support: Princeton-NSF Center for Environmental Bioinorganic Chemistry

Investigators: A. D. Anbar (UR); T. Spiro and A. Jarzecki (Princeton)

Project Title: Pilot Project: Theoretical Investigations of Transition Metal Isotope Fractionation

Award Amount: \$22,000 (internal at Princeton)

Period of Award: 9/02 – 8/03

Source of Support: National Institute of Dental Research

Principal Investigator: T. Clarkson (UR- Med. Center)

Co-Investigator(s): A. D. Anbar, G. Watson (UR- Med. Center)

Project Title: Health Effects of Dental Amalgam in Children

Award Amount: ~\$25,000 to Anbar

Period of Award: expired June, 2004

Educational Activities

Research Students Supervised

Graduate Students, as lead or co-mentor ()*

Ph.D. and M.S. Degrees in Progress (at Arizona State University)

Furukawa, Hikaru* (Ph.D. student in Geological Sciences, 3rd year)
Research Area: Earth energy futures

Hasty, Brandon (Ph.D. student in Geological Sciences, 1st year)
Research Area: Metal isotope paleoredox proxies

Sullivan, Daniel (Ph.D. student in Geological Sciences, 3rd year)
Research Area: Metal isotope paleoredox proxies

Vergeli, Pilar* (Ph.D. student in Geological Sciences, 2nd year)
Research Area: Archean ocean photochemistry

Completed Degrees, as lead or co-mentor ()*

Johnson, Aleisha (Ph.D. student in Geological Sciences, ASU, 2020)
Research Area: Mineral weathering
Present Position: Postdoctoral Scholar, the University of Chicago

Ostrander, Chad (Ph.D. student in Geological Sciences, ASU, 2020)
Research Area: Metal isotope paleoredox proxies
Present Position: Postdoctoral Scholar, Woods Hole Oceanographic Institution

Sherry, Alyssa* (M.S. student in Chemistry, ASU, 2019)
Research Area: Environmental metal isotopes
Present Position: Student, ASU Sandra Day O'Connor School of Law

Chen, Xinming (Ph.D. in Geological Sciences, M.S. in Chemistry, ASU, 2018 and 2015)
Research Area: Uranium Isotope Geochemistry
Present Position: Postdoc, Florida State University

Zhang, Feifei (Ph.D. in Geological Sciences, ASU, 2018)
Research Area: Uranium Isotope Paleoredox Proxy
Present Position: Postdoc, University of Copenhagen and Yale University

Castleberry, Parker (M.S. in Chemistry, ASU, 2017)

Research Area: Photogeochemistry

Present Position: Unknown

Bradford, Kristi (M.S. in Exploration Systems Design, ASU, 2016)

Research Area: Ca isotopes via laser fluorescence

Present Position: Senior Instrument Systems Engineer, Planetary Resources, Inc.

Neveu, Marc* (Ph.D. in Astrophysics, co-advised with Steve Desch, ASU, 2015)

Research Area: Habitability of Extraterrestrial Hydrothermal Systems

Present Position: NASA Postdoctoral Management Program Fellow

Mead, Christopher* (Ph.D. in Geological Sciences, ASU, 2014)

Research Area: Environmental Hg and Fe stable isotopes; biogeochemistry concept inventory

Present Position: Research Manager, Center for Education Through eXploration, ASU

Romaniello, Stephen (Ph.D. in Geological Sciences, ASU, 2012)

Research Area: U isotopes as paleoredox proxies

Present Position: Associate Professor, University of Tennessee - Knoxville

Brenneka, Gregory (Ph.D. in Geological Sciences, ASU, 2011)

Research Area: U stable isotopes in geochemistry

Present Position: Staff Scientist, Lawrence Livermore National Laboratory

Glass, Jennifer (Ph.D. in Geological Sciences, ASU, 2011)

Research Area: Mo in biology and evolution

Present Position: Associate Professor, Georgia Institute of Technology

Morgan, Jennifer (Ph.D. in Chemistry, ASU, 2011)

Research Area: Ca and Fe isotopes in biomedicine

Present Position: Senior Scientist, Proctor & Gamble

Duan, Yun (Ph.D. Geological Sciences, ASU, 2010)

Research Area: Fe and Mo isotopes in the geologic record

Present Position: Doctor of Physical Therapy, Swedish Medical Center, Seattle, WA

Royer, Nicole (M.S. Natural Sciences, ASU, 2007)

Research Area: Mo isotopes in the environment

Present Position: Unknown

Arnold, Gail L. (Ph.D. Geological Sciences, UR, 2004)

Research Area: Trace metals, Mo and Fe isotopes and Precambrian paleoenvironments

Present Position: Assistant Research Professor, University of Texas – El Paso

Domagal-Goldman, Shawn (M.S. Geological Sciences, UR, 2002)

Research Area: Fe isotope fractionation in sediments; atmosphere evolution

Present Position: Research Space Scientist, NASA Goddard Space Flight Center

Jones, Greg (M.S. Geological Sciences, UR, 2003)

Research Area: Distribution of fissionogenic ⁹⁹Tc in Western New York

Present Position: Senior Chemist/Radiochemist, Exelon Generation

Roe, Jo E. (Ph.D. Chemistry, UR, 2003)

Research Area: Development of MC-ICP-MS methods for studying Fe isotope fractionation

Present Position: Analyst, Excellus Corp.

Klochko, Katerina (M.S. Geological Sciences, UR, 2003)

Research Area: Mo isotope fractionation in the environment

Present Position: Physical Scientist, USGS, Reston VA

Holman, Elizabeth S. (M.S. Geological Sciences, UR, 2001)

Research Area: Theoretical modeling of Fe isotope fractionation

Present Position: Assoc. Dir of Assessment & Evaluation, U. Michigan Medical School

Knab, Karen A. (M.S. Chemistry, UR, 1999)

Research Area: Development of MC-ICP-MS methods for measuring Mo isotope fractionations

Present Position: Marriage and Family Therapist, Private Practice.

Ramon, Erick (M.S. Geological Sciences, UR, 1999)

Research Area: Redox evolution of the Earth's surface environment

Present Position: Staff Scientist, Lawrence Livermore National Laboratory

Undergraduate Students (alphabetical)

Beemiller, Peter (Junior Research, Biology B.S., UR, 2000)

Bercel, Trystyn (Junior Research, Earth & Space Exploration B.S., ASU, 2015)

Carti, Shani (Senior Research, Environmental Studies B.A., UR, 2000)

Diamond, Ashley (Junior Research, Biology B.S., ASU, 2008)

Fancher, Michael (Freshman Research, Chemistry B.S., ASU, 2011)

Fetterhoff, Kristy (Senior Thesis, Chemistry B.S., UR, 1997)

Glukhova, Alisa (Senior Research, Biochemistry B.S., ASU, 2013)

Goldman, Shawn (Senior Research, Physics B.S., UR, 2001)

Gosse, Julie (Summer Research 1998, Chemistry B.S. at U. Mass Amherst, 1999)

Hopson, Emma (Undergraduate Research, Biology B.S., ASU, 2020)

Kaplan, Mark (Senior Thesis, Chemistry B.S., UR, 1997)

Knab, K. A. (Senior Thesis, Environmental Science B.S.; Chemistry B.A., UR, 1998)

LaRossa, Gina (Summer Research 1997; Electrical Engineering B.S. at Yale, 2001)

Manubay, Grace (Senior Research, Environmental Studies B.A., UR, 1999)

Marciano, Santo (Laboratory Asst., Geological Sciences B.S., UR, 2003)

Marshall, Lisa (Senior Thesis, Chemistry B.S., UR, 2001)

Martin, Joe (Senior Research, Environmental Science B.S., UR, 1999)

Martinez, Zuriyema (Senior Research, Biochemistry B.S., ASU, 2012)

Missell, Christine (Summer Research 1999, Geology B.S. at U. Maryland, 2001)

Montanez, Gabriela (Senior Research, Chemical Engineering B.S., ASU, 2010)

Murray, Joseph (Undergraduate Research, Chemistry B.S., ASU, 2011)
Ostrander, Chad (Undergraduate Research, Geological Sciences B.S., ASU, 2016)
Peters, K. (Senior Research, Environmental Science B.S., UR, 1997)
Polizzotto, Matt (Senior Research, Environmental Science B.S., UR, 2001)
Ramon, E. (Senior Research, Biology-Geology B.S., UR, 1997)
Roche, Erik (Senior Research, Chemistry B.A., UR, 1999)
Rolfe, Bryan (Freshman – Junior Research, Chemical Engineering B.S., ASU, 2009)
Sabin, Christie (Senior Research, Biochemistry B.S., ASU, 2013)
Schultz, Laura (Senior Research, Chemistry B.S., ASU, 2008)
Shollenberger, Quinn (Undergraduate Research, Chemistry B.S., ASU, 2014)
Tegler, Logan (Undergraduate Research, Chemistry B.S., ASU, 2018)
Spaul, Hannah (Senior Research, Environmental Studies B.A., UR, 1998)
Stewart, Audrey (Laboratory Asst., Environmental Sciences B.S., UR, 2004)
Valdez, Emma (Undergraduate Research, Astrobiology B.S., ASU, 2021)
Wayne, Lily (Undergraduate Research, Biochemistry B.S., ASU, 2019)
Webber, Ben (Senior Research, Chemistry B.S., UR, 2004)
Williams, Teidra (Junior Research, Life Sciences, B.S., ASU, 2008)

Courses Taught
(most recent listed first)

Arizona State University

SES 106 (originally GLG 106)- Habitable Worlds

Semesters Taught: Fall '10-'12, '14, '15, '19, '20 Spring '17, '18 (4 credits; carries ASU SQ credit)

Using the search for life on other worlds as motivation, introduces students to basic concepts in astronomy, geosciences, chemistry, and biology needed to understand what makes the Earth a planet conducive to supporting life. Equips students to understand the future of our inhabited world and the search for life beyond our own. Class size: Offered as a pilot hybrid course to ~ 30 students in 2010, fully online to ~ 150 students in 2011, and to ~ 400 students/offering since 2012.

GLG 591- Archean Geophysics

Semesters Taught: Fall '14 (1 credit)

An overview of Archean geophysical processes and their environmental consequences.

GLG/CHM 598/494- Biogeochemical Evolution of Earth

Semesters Taught: Spring '14, Fall '15 (3 credits)

A graduate seminar covering basic concepts and key topics pertaining to Earth's habitability, its evolution over time, and co-evolution with life.

CHM 302- Environmental Chemistry

Semesters Taught: Fall '08, '09, '11, '17 (3 credits)

An introduction to chemistry in the environment. Explores major environmental issues, problems, and solutions from analytical and chemical perspectives. Class size: ~ 100

GLG 581/CHM 598- Isotope Geochemistry

Semesters Taught: Spring '05, '07, '09, '11, '13, 15, Fall '16 (3 credits)

An introduction to the basic concepts of stable and radiogenic isotope geochemistry. The course includes lectures, reading-and-discussion sessions and laboratory tutorials/demonstrations. Class size: ~ 10.

CHM 501- Current Topics in Geochemistry and Environmental Chemistry

Semesters Taught: Fall '07, '08, '09, '13, Spring '11, '16, '18 (1 credit)

Topical reading and research seminar/practicum in geochemistry an environmental chemistry.

SOS 513/GLG 490- Science for Sustainability (cross-listed as CHM 598/494, Chemistry for Sustainability)

Semesters Taught: Spring '08 (3 credits)

An orientation to natural science concepts and paradigms necessary to understand critical topics in sustainability, particularly related to global climate change. Subjects covered include the carbon cycle, nutrient cycles, carbon and nutrients in the oceans, climate change, oxygen and ozone, solid waste pollution, urban air pollution. Class size: 24.

GLG 191- Alternative Earths: Past, Future and Beyond (1st Year Seminar)

Semesters Taught: Fall '07 (1 credit)

It is only a matter of time before Earth-like planets are discovered orbiting stars other than the Sun. Will we find that environments like ours hospitable to life are common? Through examination of the four billion years of "coevolution" of life and the environment on this planet, students will gain perspective on how our civilization is shaping the Earth's future and on the prospects for life on the alternative Earths that lie beyond. Class size: ~ 10.

ASU 101- The ASU Experience

Semesters Taught: Fall '07 (1 credit)

A required class for all ASU students to teach skills needed for success in college. Class size: ~ 10.

CHM 113- General Chemistry

Semesters Taught: Fall '05, '06 (3 credits + lab)

A college-level introduction to the basic concepts of chemistry. First course in a two-semester sequence. The course includes lectures, discussion sessions and a laboratory. Class size: ~ 200.

GLG 598/490- Habitable World (cross-listed as CHM 582)

Semesters Taught: Spring '06 (3 credits)

A first course in Earth System Science for graduates and advanced undergraduates. Topics covered include planetary climate, Earth history, biogeochemical cycles; atmosphere and ocean chemistry. Class size: ~ 10.

University of Rochester

EES 103- Habitable World: An Introduction to Environmental Science

Semesters Taught: Spring '02, '03, '04 (4 credits)

An introduction to the natural physical, chemical, biological and geological processes that shape conditions at the Earth's surface, their interrelationships, and the modification of these processes by human activity. Students will learn to critically analyze scientific hypotheses and the data on which they are founded. The content of this course is similar to that of the AP Environmental Science curriculum. Class size: 25 – 40.

EES 218- The Chemistry of Global Change

Semesters Taught: Fall '01, '02, '03 (4 credits)

Quantitative survey of the processes controlling environmental conditions at the Earth's surface today, how they have changed with time, and how they are expected to change in the future. The course emphasizes the chemical composition of the atmosphere and oceans, and the chemical, biological and geological processes which affect this composition. Specific topics include: greenhouse gases and global warming; photochemistry and stratospheric ozone; geochemical cycles and feedbacks; the effects of human activities; and the methods used to study the chemical evolution of the atmosphere and oceans. Class size: 15 – 25.

EES 261/461- Aqueous Geochemistry

Semesters Taught: Fall '98, Fall '00 (4 credits)

An introduction to the chemistry of water in the environment, including both pristine and polluted systems. The composition and behavior of atmospheric waters, groundwaters and seawater will be

studied through the application of principles of inorganic chemistry and geology. Offered alternate fall semesters. Class size: ~ 15

EES 216- Environmental Geochemistry

Semesters Taught: Spring '97, '98, '99, '00 (4 credits)

A course in the chemical and physical processes that shape our environment. These include groundwater flow and contaminant migration, chemistry of lakes, streams and the ocean, ocean-atmosphere interactions, (ozone depletion) global warming and the greenhouse effect. Class size: 30 - 50

EES 466- Stable Isotope Geochemistry: Beyond the Light Elements

Semesters Taught: Spring '00 (4 credits)

Historically, research in stable isotope geochemistry has focused on isotope fractionation of H, B, O, C, N and S. However, recent work at Rochester and elsewhere has shown that the isotopes of many heavier elements also undergo measurable fractionation in nature. This research seminar will focus on these emerging stable isotope systems, with a focus on analytical methods and potential applications. Specific isotope systems to be covered include (at least): Ca, Se, Fe, Cu, Zn and Mo. Students will be expected to keep up with reading assignments, prepare informal presentations, and participate in discussions. A term project or paper is also required. Class size: ~ 5

EES 263/463- Seminar in Biogeochemistry (Astrobiology)

Semesters Taught: Spring '96, '99, '02 '03 (4 credits)

Current topics in biogeochemistry, focusing on the interface between biological and geological processes in ancient and modern environments. Coursework includes readings from the primary research literature, presentations, student-led discussions and a term paper or project. Class size: 5 - 10

EES 265/465- Chemistry of Atmospheres

Semesters Taught: Fall '97, Fall '99 (4 credits)

An introduction to the chemistry of the Earth's atmosphere, and the atmospheres of the other planets and their satellites. Special emphasis on photochemistry and chemical kinetics, and modeling of these processes in atmospheres. Effects of life and of human activities on the atmosphere will be examined, as well as the chemical evolution of the atmosphere through Earth history. Offered alternate fall semesters (odd years). Class size: ~ 15.

EES 100Q- The Early Earth and the Origin of Life (1st Year "Quest" Course)

Semesters Taught: Fall '96 (4 credits), Spring '97 (EES 200), Spring '98 (2 credits)

Students will focus on conditions of the early Earth and theories of the origin of life through presentations, discussions and debates, guided by their readings of primary research articles. This course is designed to reinforce basic concepts in chemistry, biology and earth science in a problem-oriented manner, and to demonstrate the interrelationships between specific disciplines. Students will learn to critically and quantitatively analyze scientific hypotheses, and the data on which they are founded. Class size: ~ 15.

CAS 160- Public Speaking

Semesters Taught: Fall '97 (2 credits)

The intent of this course is to provide students the opportunity to improve their oral presentation and interview skills. Various presentation types will be covered, including scientific, business and

instructional presentations, speeches, and extemporaneous speaking. Students will develop skills as both interviewers and interviewees. Class size: ~ 10.

Other Significant Educational Activities

Arizona State University

Director, Center for Education Through eXploration

School of Earth & Space Exploration, 2015 – present

Direct a team of ~ 15 staff developing digital learning experiences that feature guided active learning for ASU and non-ASU use. Flagship projects include the \$10 million NASA Infiniscope project (<http://infiniscope.org>), contributions to the new SESE Astronomy online program, as well as several projects with the School of Sustainability, and two funded projects with the Howard Hughes Medical Institute.

Online Course Development

School of Earth & Space Exploration and ASU Online, 2009 – present

Articulated curricular and pedagogical goals for an interactive online quantitative science course that would be part of the BA curriculum in Earth and Environmental Studies, leading to the development and offering of Habitable Worlds (GLG 106). Effort dovetailed with development of the Arizona Science Education Collaborative (ASEC) between CLAS and the Mary Lou Fulton Teacher's College. Software development was supported by funds from ASU Online, CLAS, and the NASA Astrobiology Program. This course was offered by Anbar as a hybrid course in Fall '10, then fully online in Fall '11 and Fall '12. It was offered by development partner Dr. Lev Horodyskyj in Spring '12. See: <http://habworlds.org>.

Academic Program Reform

Arizona State University, 2013 – 2014

In Fall Semester, 2013, chaired a Working Group charged by Provost Elizabeth Phillips to reconceptualize the ASU general education curriculum required of all ASU students. The group included 6 faculty from across the university's knowledge domains. Our recommendations, explained in a draft report submitted to the Provost's Office in December, 2012, called for a general studies curriculum in which courses across knowledge domains would be organized around, and motivated by, thematic, transdisciplinary, multi-year projects.

TED-Ed Video – Finding Habitable Worlds

School of Earth & Space Exploration, Spring-Summer-Fall 2012

Devised concept and script for a TED-Ed video, and associated “flipped” lesson, about the search for habitable worlds beyond the Earth. See: <http://ed.ted.com/lessons/a-needle-in-countless-haystacks-finding-habitable-planets-ariel-anbar>.

Education Research

School of Earth & Space Exploration, 2010 – 2015

Developed a funded research plan for the NSF program *Transforming Undergraduate Education in STEM*, centered on modification and assessment of effectiveness of Habitable Worlds (GLG 106) as a platform to teach scientific reasoning. Awarded \$600,000 (Co-PI: Prof. Steven Semken). Project begins

in January, 2013. Also served as Co-I with PI Steven Semken on a NASA project to infuse NASA science content into the national K-12 geoscience curricula.

Virtual Field Trip Development

School of Earth & Space Exploration and AZ Sci. Ed. Collaborative (ASEC), 2010 – present

With financial support from NASA, ASU Online, and the Mary Lou Fulton Teachers College, oversaw effort by the ASU Astrobiology Program to develop a suite of scientific “virtual field trips”. These products, developed by technologist Mr. Geoffrey Bruce, are being used in Habitable Worlds, by ASEC, and by faculty in the School of Human Evolution and Social Change (SHESC). See: <http://vft.asu.edu>.

Curriculum Development

School of Sustainability (SOS), 2006 – 2008

Helped Profs. Charles Redman and Charles Perrings devise curricula for ABOR approval of SOS curriculum, based on the syllabi for EES 103 (“Habitable World”) and EES 218 (“Chemistry of Global Change”). These provided models for SOS 513 (“Science for Sustainability”) and SOS 110 (“Sustainable World”). Also served as the first instructor for SOS 513 in Spring, 2008.

Curriculum Development

Dept. of Chemistry & Biochemistry, 2008 – 2009

Worked with faculty in the environmental/geochemistry division of the Department as well as faculty on the department’s Committee on Sustainability to explore reinventing the Environmental Chemistry undergraduate degree program as a Sustainable Chemistry program.

Honors Disciplinary Advisor

Dept. of Geological Sciences and School of Earth & Space Exploration, 2005 – 2009

Worked with faculty in the Dept. of Geological Sciences (later the School of Earth & Space Exploration) and staff at the Barrett Honors College to facilitate connections between Barrett students and the Dept. Includes connecting Honors majors with potential thesis advisors and raising awareness of geosciences among Honors students.

University of Rochester

Faculty-in-Residence

Crosby Hall: '96 – '97; Hoeing Hall: '97 – '98; '98 – '99

Lived in undergraduate residence hall. Planned and executed programming designed to stimulate student/faculty interactions outside the classroom.

Residential College Commission

Residential Life Subcommittee, Fall '97 – '99

Participated as one of two faculty representatives, and co-author of final report. The subcommittee was charged with developing recommendations to improve the collegiate experience for students in residence at UR. The major recommendation of the report was to call for unified freshman housing.

Freshman Housing Implementation Committee/Freshman Advisory Committee

Spring '00 – Spring '02

Participated in planning for freshman housing implementation. Chaired subcommittee dealing with impact on fraternities and special interest housing, subcommittee elucidating mechanisms to link the freshman class and the College, and subcommittee on modifying freshman orientation experience.

Faculty Advisor, Sigma Epsilon Fraternity

Spring '01 – present

Worked with students to develop academically-oriented programs.

Hillel of Rochester Area Colleges, V.P.- Campus Affairs

Fall '01 – Fall '02

Oversaw review of Hillel-supported campus programming for undergraduate Jewish students.

National

Inspark Science Network

Academic Lead, 2015 – present

Inspark (<http://inspark.education>) is a digital teaching network created as part of a \$4.5 million award from the Bill and Melinda Gates Foundation to a partnership led by edtech pioneer Smart Sparrow and ASU. It brings together > 100 instructors at > 50 community colleges and other institutions around the country to advance the art of digital teaching and learning, focused in particular on low-income and disadvantaged learners, following a model of learning design developed in ASU Center for Education Through eXploration.