

Ariel D. Anbar

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Professor
School of Earth & Space Exploration
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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

- 2009 – present Professor
- 2004 – 2009 Associate Professor
School of Earth & Space Exploration (formerly Dept. of Geological Sciences)
School of Sustainability (since 2007)
and Dept. of Chemistry & Biochemistry
Arizona State University
- 2002 – 2004 Associate Professor
- 1996 – 2002 Assistant Professor
Dept. of Earth & Environmental Sciences
Dept. of Chemistry
University of Rochester
- 1989 – 1996 Graduate Research Assistant and Graduate Teaching Assistant
Division of Geological and Planetary Sciences
California Institute of Technology

Post-Ph.D. Supervisees

- Dr. Gail Arnold, Ph.D. 2004, U. Rochester; ASU Research Scientist, '05 – '07
- Dr. Jane Barling, Ph.D. 1990, Monash University; UR Research Scientist, '98 – '02
- Dr. Gwyneth Gordon, Ph.D. 2002, Yale University; ASU Research Scientist '03 – present
- Dr. Brian Kendall, Ph.D. 2008, U. Alberta; Agouron Postdoctoral Fellow (ASU), '08 – present
- Dr. Brian Majestic, Ph.D. 2007, U. Wisc.; Dreyfus Env. Sci. Fellow (ASU), '07 – '09
- Dr. Christopher Siebert, Ph.D. 2002, U. Bern (Switzerland), ASU Postdoct. Fellow, '05 – '06
- Dr. Laura Wasylenki, Ph.D. 1998, Caltech; ASU Research Scientist, '04 – present
- Dr. Felisa Wolfe-Simon, Ph.D. 2006, Rutgers; ASU Postdoct. Fellow, '06 – '07
- Dr. Gregory Wortman, Ph.D. 1998, Syracuse University; UR Research Associate, '99 – '01

Awards & Honors

Individual

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

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
Student Poster 1st Prize, AbSciCon, Gail Arnold (UR), 2004
Outstanding Student Poster, AGU, Matt Polizzotto (UR), 2000
Goldwater Scholarship, Matt Polizzotto (UR), 2000

Professional Service

NASA and Related

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 – present
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 – present
Member of Steering Committee, Astrobiology Drilling Program, 2003 – present
Panelist, NASA Early Career Workshop, LPSC Meeting, '04

Other Extramural

Editorial Board, *Geology* (GSA), 2003 – 2005; 2006 – present
Editorial Board, *Chemical Geology* (Elsevier), 2006 – present
Editorial Board, *Metallomics* (RSC), 2008 – present
Editorial Advisory Board, *Geobiology* (Blackwell Publishing), 2003 – 2008
Elected Councillor, Int'l Society for the Study of the Origin of Life; ISSOL, 2008 - present
Co-Chair, Gordon Conference on Environmental Bioinorganic Chemistry, 2008 – 2010
Member, International Program Committee, Goldschmidt '05, '06
Co-Convener: ~ 20 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)
Reviewer of ~ 60 publications for GCA, EPSL, Chem. Geol., Anal. Chem., Science, Nature
Reviewer of ~ 60 proposals for NSF and NASA

ASU – SESE/GLG

Personnel Committee, 2008 – 2009 (sabbatical substitute)
Graduate Committee, 2005 – 2008 (Chair of Oversight Subcommittee, 2007-2008)
Faculty Search Advisory Committee, 2006
GLG/SESE Honors Disciplinary Advisor, 2005 – 2007
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

Personnel and Budget Committee, 2008 – present
Strategic Planning – Chemistry of Global Sustainability – Committee, 2008
Strategic Planning Committee, 2007
Awards Committee, 2007 – 2008
Bioinorganic Search Committee, 2005
Septennial Review Committee, 2005
Seminar Committee, 2004 – 2005

ASU – Other

Director, Astrobiology Program, 2009 – present
Origins Project Faculty Advisory Committee, 2009 – present
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

Publications and Presentations

* = Anbar-advised student first author

= Anbar-advised postdoc or staff first author

¥ = Anbar-advised visiting student or scientist first author

Publications in Print or Press:

1. *G. A. Brennecka, S. Weyer, M. Wadhwa, P. Janney, A. D. Anbar and J. Zipfel (2010). $^{238}\text{U}/^{235}\text{U}$ variations in meteorites: extant ^{247}Cm and implications for Pb-Pb dating. *Science* **327**: 449-451.
2. *G. A. Brennecka, L.E. Borg, I. D. Hutcheon, M. A. Sharp and A. D. Anbar (2010). Natural variations in uranium isotope ratios of uranium ore concentrates: Understanding the $^{238}\text{U}/^{235}\text{U}$ fractionation mechanism. *Earth Planet. Sci. Lett.* **291**: 228-233.
3. ¥T. W. Dahl, A. D. Anbar, G. W. Gordon, M. T. Rosing, R. E. Frei and D. E. Canfield (2010). The behavior of molybdenum and its isotopes across the chemocline and in the sediments of sulfidic Lake Cadagno, Switzerland. *Geochimica Cosmochimica Acta* **74**: 144-163.
4. *Y. Duan, A. D. Anbar, G. Gordon, S. Severmann, T. W. Lyons and B. Sageman (2010). Isotopic evidence for Fe cycling and repartitioning in ancient oxygen-deficient settings: Examples from black shales of the mid-to-late Devonian Appalachian basin. *Earth Planet. Sci. Lett.* **290**: 244-253.
5. *J. Glass, F. Wolfe-Simon, J. J. Elser and A. D. Anbar (2010). Molybdenum–nitrogen co-limitation in freshwater and coastal heterocystous cyanobacteria. *Limnol. Oceanogr.* **55**: 667-676.
6. *H. Beraldi-Campesi, H. E. Hartnett, A. D. Anbar, G. W. Gordon and F. Garcia-Pichel (2009). Effects of biological soil crusts on soil elemental concentrations: implications for biogeochemistry and as traceable biosignatures of ancient life on land. *Geobiology* **7**: 348-359.
7. #G. W. Gordon, T. W. Lyons, G. L. Arnold, J. E. Roe, B. B. Sageman and A. D. Anbar (2009). When do black shales tell molybdenum isotope tales? *Geology* **37**: 535-538.
8. T. W. Lyons, A. D. Anbar, S. Severmann, C. Scott and B. C. Gill (2009). Tracking euxinia in the ancient ocean: a multiproxy perspective and Proterozoic case study. *Ann. Rev. Earth Planet. Sci.* **37**, 507-534.

9. [#]B. Majestic, A. D. Anbar and P. Herckes (2009). Measuring natural variations of iron isotopic composition in atmospheric aerosols for use in source-apportionment studies. *Env. Sci. Tech.* **43**: 4327-4333.
10. [#]B. J. Majestic, A. D. Anbar and P. Herckes (2009). Elemental and iron isotopic composition of aerosols collected in a parking structure. *Sci. Total Env.* **407**: 5104-5109.
11. J. Garvin, R. Buick, A. D. Anbar, G. L. Arnold and A. J. Kaufman (2009). Isotopic evidence for an aerobic nitrogen cycle in the latest Archean. *Science* **323**: 1045-1048.
12. ^{*}J. B. Glass, F. Wolfe-Simon and A. D. Anbar (2009). Coevolution of marine metal availability and photoautotrophic nitrogen assimilation. *Geobiology* DOI 10.1111/j.1472-4669.2009.00190.x.
13. [‡]B. Kendall, R. A. Creaser, G. W. Gordon and A. D. Anbar (2009). Re-Os, Mo, and Fe isotope systematics of black shales from the Proterozoic Velkerri and Wollongorang Formations, McArthur Basin, Northern Australia. *Geochim. Cosmochim. Acta* **73**: 2534-2558.
14. J. A. Mikucki, A. Pearson, D. T. Johnston, A. V. Turchyn, J. Farquhar, D. P. Schrag, A. D. Anbar, J. C. Priscu and P. A. Lee (2009). A contemporary microbially maintained subglacial ferrous 'ocean'. *Science* **324**: 397 – 400.
15. H. Ohmoto, B. Runnegar, L. R. Kump, M. L. Fogel, B. Kamber, A. D. Anbar, P. L. Knauth, D. R. Lowe, D. Y. Sumner and Y. Watanabe (2009). Biosignatures in ancient rocks: a summary of discussions at a field workshop on biosignatures in ancient rocks. *Astrobiology* **8**: 883-907.
16. C. Reinhard, R. Raiswell, C. Scott, A. D. Anbar and T. W. Lyons (2009). A late Archean sulfidic sea stimulated by early oxidative weathering of the continents. *Science* **326**: 713-716.
17. [‡]U. Ryb, A. Matthews, Y. Erel, G. Gordon and A. D. Anbar (2009). Large molybdenum isotope variations in a continental rift setting. *Geology* **37**: 463-466.
18. [‡]S. Severmann and A. D. Anbar (2009). Reconstructing paleoredox conditions through a multi-tracer approach: the key to the past is the present. *Elements*, **5**: 359-364.
19. [#]F. Wolfe-Simon, P. C. W. Davies and A. D. Anbar (2009). Did nature also choose arsenic? *Internat. J. Astrobiology*, doi:10.1017/S1473550408004394.
20. A. D. Anbar (2008). Elements and evolution. *Science* **322**: 1481-1483.
21. A. D. Anbar and G. W. Gordon (2008). Redox renaissance. *Geology*, **36**: 271-272.

22. [‡]C. Scott, T. W. Lyons, A. Bekker, Y. Shen, S. W. Poulton, X. Chu and A. D. Anbar (2008). Tracing the stepwise oxygenation of the Proterozoic ocean. *Nature*, **452**: 456-459.
23. O. F. Overinde, C. L. Weeks, A. D. Anbar and T. G. Spiro (2008). Solution structure of molybdic acid from Raman spectroscopy and DFT analysis. *Inorg. Chim. Acta*, **361**: 1000-1007.
24. [‡]S. Severmann, T. W. Lyons, A. D. Anbar, J. McManus and G. Gordon (2008). Modern iron isotope perspective on the benthic iron shuttle and the redox evolution of ancient oceans. *Geology* **36**: 487-490.
25. [#]L. E. Wasylenki, B. A. Rolfe, C. Weeks, T. Spiro and A. D. Anbar (2008). Experimental investigation of the effects of temperature and ionic strength on Mo isotope fractionation during adsorption to manganese oxides. *Geochim. Cosmochim. Acta* **72**: 5997-6005.
26. [‡]S. Weyer, A. D. Anbar, A. Gerdes, G. W. Gordon, T. J. Algeo and E. A. Boyle (2008). Natural fractionation of ²³⁸U/²³⁵U. *Earth Planet. Sci. Lett.*, **72**: 345 – 359.
27. P. E. Carrigan, J. G. Hentz, G. Gordon, J. L. Morgan, M. Raimondo, A. D. Anbar and L. J. Miller (2007). Distinctive heavy metal composition of pancreatic juice in patients with pancreatic carcinoma. *Cancer, Epidemiol., Biomarkers Prevent.*, **16**: 2656-2663.
28. A. D. Anbar, Y. Duan, T. W. Lyons, G. L. Arnold, B. Kendall, R. A. Creaser, A. J. Kaufman, G. Gordon, C. Scott, J. Garvin and R. Buick (2007). A whiff of oxygen before the Great Oxidation Event? *Science*, **317**: 1903-1906.
29. A. J. Kaufman, D. T. Johnston, J. Farquhar, A. L. Masterson, T. W. Lyons, S. Bates, A. D. Anbar, G. L. Arnold, J. Garvin and R. Buick (2007). Global biospheric oxygenation and atmospheric evolution at the close of the Archean Eon. *Science*, **317**: 1900-1903.
30. [#]L. E. Wasylenki, A. D. Anbar, L. J. Liermann, R. Mathur, G. W. Gordon and S. L. Brantley (2007). Isotope fractionation during microbial metal uptake measured by MC-ICP-MS. *J. Anal. Atom. Spectr.*, **22**: 905-910.
31. L. Liermann, E. Hausrath, A. D. Anbar and S. L. Brantley (2007). Assimilatory and dissimilatory processes of microorganisms affecting metals in the environment. *J. Anal. Atom. Spectr.*, **22**: 867-877.
32. A. D. Anbar and O. Rouxel (2007). Metal stable isotopes in paleoceanography. *Ann. Rev. Earth Planet. Sci.* **35**: 717-746.
33. K. O. Konhauser, L. Amskold, S. V. Lalonde and A. Anbar (2007). Decoupling photochemical Fe(II) oxidation from shallow-water BIF deposition. *Earth Planet. Sci. Lett.*, **258**: 87-100.

34. J. Skulan, T. Bullen, A. D. Anbar, J. E. Puzas, L. Shackelford, A. LeBlanc and S. Smith (2007). Natural calcium isotopic composition of urine as a marker of bone mineral balance. *Clin. Chem.*, **53**: 1155-1158.
35. C. L. Weeks, A. D. Anbar, L. E. Wasylenki and T. G. Spiro (2007). DFT analysis of molybdenum isotope fractionation. *J. Phys. Chem. A* **111**: 12434-12438. See also correction in **112**: 10703 (2008).
36. S. Weyer, A. D. Anbar, G. P. Brey, C. Munker, K. Mezger and A. B. Woodland (2007). Fe-isotope fractionation during partial melting on Earth and the current view on the Fe-isotope budgets of the planets (Reply to the comment of F. Poitrasson and to the comment of B.L. Beard and C.M. Johnson on "Iron isotope fractionation during planetary differentiation" by S. Weyer, A. D. Anbar, G. P. Brey, C. Munker, K. Mezger and A. B. Woodland). *Earth Planet Sci. Lett.* **56**: 638-646.
37. A. D. Anbar, A. Jarzecki and T. Spiro (2005). Theoretical investigation of iron isotope fractionation between $\text{Fe}(\text{H}_2\text{O})_6^{3+}$ and $\text{Fe}(\text{H}_2\text{O})_6^{2+}$: implications for iron stable isotope geochemistry. *Geochim. Cosmochim. Acta*, **69**: 825-837.
38. A. D. Anbar, G. L. Arnold, T. W. Lyons and J. Barling (2005). Response to comment on "Molybdenum isotope evidence for widespread anoxia in mid-Proterozoic oceans". *Science* **309**: doi:10.1126/science.1105521.
39. B. M. Jakosky, A. D. Anbar, D. Des Marais, D. Morrison and N. R. Pace (2005). Don't dismiss astrobiology. *Science* **308**: 496.
40. L. J. Liermann, A. Marin, V. LeBron, R. L. Guynn, J. Barling, A. D. Anbar and S. L. Brantley (2005). Metal-targeted dissolution of silicates by soil bacteria. *Chem. Geol.* **220**: 285-302.
41. S. Weyer, C. Munker, G. Brey, A. Woodland, K. Metzger and A. D. Anbar (2005). Iron isotope fractionation during planetary differentiation. *Earth Planet Sci. Lett.*, **240**: 251-264.
42. A. D. Anbar (2004). Molybdenum stable isotopes: Observations, interpretations and directions. *Rev. Mineral. Geochem.* **55**: 429-454.
43. *G. L. Arnold, A. D. Anbar, J. Barling and T. W. Lyons (2004). Molybdenum isotope evidence of widespread anoxia in mid-Proterozoic oceans. *Science* **304**: 87-90.
44. S. L. Brantley, L. J. Liermann, A. D. Anbar, G. A. Icopini, R. L. Guynn and J. Barling (2004). Fe isotopic fractionation during mineral dissolution. *Geochim. Cosmochim. Acta*, **68**: 3189-3204.
45. A. Jarzecki, A. D. Anbar and T. Spiro (2004). DFT investigation of vibrational spectra of $\text{Fe}(\text{H}_2\text{O})_6^{3+}$ and $\text{Fe}(\text{H}_2\text{O})_6^{2+}$. *J. Phys. Chem. A* **108**: 2726-2732.

46. G. A. Icopini, S. Ruebush, M. Tien, A. D. Anbar and S. L. Brantley (2004). Iron isotope fractionation during microbial reduction of iron: the importance of adsorption. *Geology* **32**: 205-208.
47. A. D. Anbar (2004). Iron stable isotopes: beyond biosignatures. *Earth Planet. Sci. Lett. (Frontiers)* **217**: 223-236.
48. *G. L. Arnold, S. Weyer and A. D. Anbar (2004). Iron isotope variations in natural materials measured using high mass resolution MC-ICP-MS. *Anal. Chem.* **76**: 322-327.
49. #J. Barling and A. D. Anbar (2004). Molybdenum isotope fractionation during adsorption by manganese oxides. *Earth Planet. Sci. Lett.* **217**: 315-329.
50. O. Katz, M. Beyth, N. Mille, R. Stern, D. Avigad, A. R. Basu and A. D. Anbar (2004). A Late Neoproterozoic (~630 Ma) Boninitic Suite from southern Israel: Implications for the consolidation of Gondwanaland. *Earth Planet. Sci. Lett.* **218**: 475-490.
51. *J. E. Roe, A. D. Anbar and J. Barling (2003). Nonbiological fractionation of Fe isotopes: Evidence of an equilibrium isotope effect. *Chem. Geol.* **195**: 69-85.
52. A. D. Anbar and A. H. Knoll (2002). Proterozoic ocean chemistry and evolution: A bioinorganic bridge? *Science* **297**, 1137-1142.
53. #J. Barling, G. L. Arnold and A. D. Anbar (2001). Natural mass-dependent variation in the isotopic composition of molybdenum. *Earth Planet. Sci. Lett.* **193**: 447-457.
54. M. Sharma, M. L. Polizzotto and A. D. Anbar (2001). Iron isotopes in hydrothermal fluids at the Juan de Fuca ridge. *Earth Planet. Sci. Lett.* **194**: 39-51.
55. A. D. Anbar, K. A. Knab and J. Barling (2001). Precise determination of mass-dependent variations in the isotopic composition of Mo using MC-ICP-MS. *Anal. Chem.* **73**: 1425-1431.
56. A. D. Anbar, K. J. Zahnle, G. L. Arnold and S. J. Mojzsis (2001). Extraterrestrial iridium, sediment accumulation and the habitability of the early Earth's surface. *J. Geophys. Res.* **106**: 3219-3236.
57. P. A. Karam, S. A. Leslie and A. D. Anbar (2001). The effects of changing atmospheric oxygen concentrations and background radiation levels on radiogenic DNA damage rates. *Health Phys.* **81**: 545-553.
58. A. D. Anbar (2001). Iron isotope biosignatures: promise and progress. *EOS* **83**: 173, 178-179.
59. A. D. Anbar, J. E. Roe, J. Barling and K. H. Nealson (2000). Non-biological fractionation of iron isotopes. *Science* **288**: 126-128.

60. A. D. Anbar, D. A. Papanastassiou and G. J. Wasserburg (1997). The determination of iridium in natural waters by clean chemical preconcentration and negative thermal ionization mass spectrometry. *Anal. Chem.* **69**: 2444-2450.
61. A. D. Anbar, G. J. Wasserburg, D. A. Papanastassiou and P. S. Andersson (1996). Iridium in natural waters. *Science* **273**: 1524-1528.
62. A. D. Anbar, F. Chavez and Y. L. Yung (1996). Methyl bromide: Ocean sources, ocean sinks and climate sensitivity. *Global Biogeochem. Cycles* **10**: 175-190.
63. H. Nair, M. Allen, A. D. Anbar, Y. L. Yung and R. T. Clancy (1994). Photochemistry of the Martian atmosphere. *Icarus* **111**: 124-150.
64. A. D. Anbar and M. Allen (1993). Photodissociation in the atmosphere of Mars: Impact of high resolution, temperature-dependent CO₂ cross section measurements. *J. Geophys. Res.- Planets* **98**: 10,925-10,931.
65. A. D. Anbar, M-T. Leu, H. A. Nair and Y. L. Yung (1993). The adsorption of HO_x on aerosol surfaces: Implications for the atmosphere of Mars. *J. Geophys. Res.- Planets* **98**: 10,933-10,940.
66. A. D. Anbar, D. A. Papanastassiou, R. A. Creaser and G. J. Wasserburg (1992). Rhenium in seawater: Confirmation of generally conservative behavior. *Geochim. Cosmochim. Acta* **56**: 4099-4103.
67. A. D. Anbar and H. D. Holland (1992). The photochemistry of manganese and the origin of banded iron formations. *Geochim. Cosmochim. Acta* **56**: 2595-2603.
68. M-T. Leu, J. Blamont, A. D. Anbar, L. F. Keyser, and S. P. Sander (1992). Adsorption of CO on water-ice and oxide surfaces: Implications for the Martian atmosphere. *J. Geophys. Res.- Planets* **97**: 2621-2627.

Publications in Revision or Review:

1. [#]B. Kendall, A. J. Kaufman, C. Reinhard, T. W. Lyons and A. D. Anbar. Stratified ocean redox chemistry prior to the Great Oxidation Event. *Nature – Geosciences*, submitted.
2. K. J. Knudson, H. M. Williams, J. E. Buikstra, P. D. Tomczak, G. W. Gordon and A. D. Anbar. Introducing $\delta^{88/86}\text{Sr}$ analysis in archaeology: a demonstration of the utility of strontium isotope fractionation in paleodietary studies. *J. Archeol. Sci.*, in revision.
3. ^{*}J. L. Morgan, L. E. Wasylenki and A. D. Anbar. Binding affinity of Fe-ligand complexes and equilibrium Fe isotope fractionation. *Env. Sci. Tech.*, in revision.

Publications in Preparation (selected):

1. K. Alexander, A. D. Anbar, F. Garcia-Pichel and H. Hartnett. Relationship between trace element mobilization and metabolic requirements in biological soil crusts. In preparation for *Geobiology*.
2. *G. Brennecka, L. E. Wasylenki, S. Weyer and A. D. Anbar. Uranium isotope fractionation during adsorption to manganese oxides. In preparation for *Env. Sci. Tech.*
3. *Y. Duan, A. D. Anbar, G. L. Arnold, G. W. Gordon, S. Severmann and T. W. Lyons. Iron isotope variations in the ~2.5 Ga Mt. McRae Shale. In preparation for *Geochimica Cosmochimica Acta*.
4. *Y. Duan, A. D. Anbar, G. L. Arnold, T. Lyons and G. Gordon. Molybdenum isotopic composition in the ~ 2.5 Ga McRae Shale, Hamersley Basin, Western Australia: An early whiff of oxygen? In preparation for *Geology*.
5. #G. W. Gordon, K. McLeod, T. W. Lyons, A. Matthews, H. Jenkyns and A. D. Anbar. Molybdenum isotope variations during OAE2. In preparation for *Earth Planet. Sci. Lett.*
6. A. D. Herrmann, L. E. Wasylenki, T. Algeo and A. D. Anbar. Molybdenum isotope record of the Hushpuckney shale (Missourian Stage, Eastern Kansas): Implications for regional paleoceanographic conditions and anoxia. In preparation for *Geology*.
7. #B. Kendall, G. W. Gordon, S. W. Poulton and A. D. Anbar. Mo isotope paleoredox proxy applied to black shales of the 1.8 Ga Rove Formation, Animikie Group, Canada. In preparation for *Chemical Geology*.
8. #L. E. Wasylenki, T. Lund, J. R. Bargar and A. D. Anbar. Molybdenum isotope fractionation during adsorption to ferrihydrite. In preparation for *G³*.
9. #L. E. Wasylenki, A. D. Anbar and S. L. Brantley. The role of organic ligands in Fe isotope fractionation during dissolution of hornblende. In preparation for *Chem. Geol.*
10. #L. E. Wasylenki, J. Bargar, C. L. Weeks, T. G. Spiro, and A. D. Anbar. X-ray absorption spectroscopy and density functional theory reveal the molecular mechanism of Mo isotope fractionation during adsorption to birnessite. In preparation for *Geochim Cosmochim Acta*.

Reports and White Papers (not peer reviewed):

1. Anbar, A. D., Grinspoon, D., Solomon, S. C. and Taylor, G. J. (2009). Astrobiology Research Priorities for Mercury, Venus and the Moon: A White Paper for the 2009 – 2011 Planetary Science Decadal Survey.
<http://www8.nationalacademies.org/ssbsurvey/publicview.aspx>

2. Pratt, L.M., C. Allen, A.C. Allwood, A. Anbar, S.K. Atreya, D.W. Beaty, M.H. Carr, J.A. Crisp, D.J. Des Marais, J.A. Grant, D.P. Glavin, V.E. Hamilton, K. Herkenhoff, V. Hipkin, B. Sherwood Lollar, T.M. McCollom, A.S. McEwen, S.M. McLennan, R.E. Milliken, D.W. Ming, G.G. Ori, J. Parnell, F. Poulet, C.G. Salvo, F. Westall, C.W. Whetsel, and M.G. Wilson (2009) Mars Astrobiology Explorer-Cacher: A potential rover mission for 2018, Final report from the Mid-Range Rover Science Analysis Group (MRR-SAG), 94 pp., posted November 10, 2009, by the Mars Exploration Program Analysis Group (MEPAG) at <http://mepag.jpl.nasa.gov/reports/>
3. Taylor, G J. and the rest of the Lunar Exploration Analysis Group SASS-SAT (2005). Rapid Response Report: LEAG Science Activities and Site Selection Specific Action Team (SASS-SAT). Unpublished white paper, commissioned by the NASA Chief Scientist.
4. Jakosky, B, Anbar, A. D., Taylor, G. J. and Lucey, P. (2004). Astrobiology Science Goals and Lunar Exploration. Unpublished white paper, 12 p, posted July, 2004 by the NASA Astrobiology Institute (NAI) at http://nai.arc.nasa.gov/institute/lunar_astrobiology.cfm
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105. T. W. Lyons, A. D. Anbar, B. C. Gill, S. R. Meyers, B. B. Sageman, A. M. Cruse, P. Wilde and C. T. Scott (2003). Molybdenum accumulation in organic-rich sediments and sedimentary rocks. *2003 Meeting of the Geological Society of America*, Seattle, WA.
106. A. D. Anbar and T. M. Johnson (2003). Oxyanion stable isotopes and ocean paleoredox. *13th V. M. Goldschmidt Conference*, Kurashiki, Japan.
107. A. Jarzecki, A. D. Anbar and T. Spiro (2003). Iron isotope fractionation between $\text{Fe}(\text{H}_2\text{O})_6^{2+}$ and $\text{Fe}(\text{H}_2\text{O})_6^{3+}$. *13th V. M. Goldschmidt Conference*, Kurashiki, Japan.
108. #G. W. Williams, A. D. Anbar and G. L. Arnold (2003). Preservation of molybdenum isotope signatures in black shales. *13th V. M. Goldschmidt Conference*, Kurashiki, Japan.
109. A. D. Anbar, A. Jarzecki and T. Spiro (2003). Modeling equilibrium Fe isotope fractionation. *AGU-EUG-EGS joint meeting*, Nice, France.

110. S. Weyer, G. L. Arnold, R. Chakrabarti and A. D. Anbar (2003). Iron isotope fractionation at high temperatures. *AGU-EUG-EGS joint meeting*, Nice, France.
111. A. D. Anbar, R. Buick, R. Grymes, S. Mojzsis, M. Nedachi, H. Ohmoto and B. Runnegar (2003). The Astrobiology Drilling Program of the NASA Astrobiology Institute. *AGU-EUG-EGS joint meeting*, Nice, France.
112. A. D. Anbar, R. L. Guynn, L. J. Liermann, G. Icopini, J. Barling and S. L. Brantley (2003). Fe isotope fractionation during silicate weathering. *AGU-EUG-EGS joint meeting*, Nice, France.
113. A. D. Anbar, R. Buick, R. Grymes, S. Mojzsis, M. Nedachi, H. Ohmoto and B. Runnegar (2003). The Astrobiology Drilling Program of the NASA Astrobiology Institute. *AGU-EUG-EGS joint meeting*, Nice, France.
114. * G. L. Arnold, A. D. Anbar and J. Barling (2003). Molybdenum isotopes and oxygenation of the mid-Proterozoic ocean. *NASA Astrobiology Institute Annual Meeting*, Tempe, AZ.
115. * G. L. Arnold, A. D. Anbar and J. Barling (2002). Molybdenum isotopes and oxygenation of the mid-Proterozoic ocean. *EOS Trans. AGU* **83**, Fall Meet. Suppl., Abstract V22D-09, 2002.
116. A. D. Anbar and A. H. Knoll (2002). Sulfur isotopes as paleoenvironmental indicators: Evolutionary implications. *2002 Meeting of the Geological Society of America*, Denver, CO.
117. * G. L. Arnold, A. D. Anbar and J. Barling (2002). Oxygenation of Proterozoic oceans: Insight from molybdenum isotopes. *12th V. M. Goldschmidt Conference*, Davos, Switzerland.
118. A. D. Anbar, G. L. Arnold, R. Rye and S. Weyer (2002). Iron isotopes in an Archean paleosol. *12th V. M. Goldschmidt Conference*, Davos, Switzerland. **Invited.**
119. # J. Barling and A. D. Anbar (2002). Mass-dependent fractionation of molybdenum isotopes scavenged by manganese oxyhydroxides. *12th V. M. Goldschmidt Conference*, Davos, Switzerland.
120. A. D. Anbar, R. Rye and A. J. Kaufman (2001). Explaining the Paleoproterozoic rise of O₂. *Eos Trans. AGU* **82**, all Meet. Suppl., Abstract P21C-09, 2001.
121. # J. Barling and A. D. Anbar (2001). Experimental study of mass-dependent fractionation of molybdenum isotopes scavenged during precipitation of manganese oxyhydroxides. *Eos Trans. AGU* **82**, Fall Meet. Suppl., Abstract V22D-08, 2001.
122. S. L. Brantley, A. D. Anbar, R. Guynn, J. Barling, L. Liermann, G. Icopini (2001). Fe release and isotopic fractionation during dissolution of hornblende and goethite in the

- presence of soil bacteria. *Eos Trans. AGU* **82**, Fall Meet. Suppl., Abstract V21A-0970, 2001.
123. A. Saha, A. R. Basu, J. Barling, A. D. Anbar, P. R. Hooper (2001). Hf-Nd isotopic correlation in the Deccan Flood Basalt Province. *Eos Trans. AGU* **82**, Fall Meet. Suppl., Abstract V52B-05, 2001.
124. R. Buick, A. D. Anbar, S. J. Mojzsis, A. J. Kaufman, T. L. Kieft, T. W. Lyons and M. Humayun (2001). The case for scientific drilling of Precambrian sedimentary sequences: A mission to early Earth. *Eos Trans. AGU* **82**, Fall Meet. Suppl., Abstract P22B-0544, 2001.
125. A. D. Anbar, R. Buick, S. J. Mojzsis, A. J. Kaufman, T. L. Kieft, T. W. Lyons and M. Humayun (2001). The case for scientific drilling of precambrian sedimentary sequences: A mission to early Earth. *2001 Meeting of the Geological Society of America*, Boston, MA.
126. *G. L. Arnold, J. Barling and A. D. Anbar (2001). Molybdenum stable isotopes: A potential new tool for quantifying the extent of bottom water anoxia. *2001 Meeting of the Geological Society of America*, Boston, MA.
127. *J. E. Roe, A. D. Anbar and J. Barling (2001). Mechanisms of nonbiological fractionation of Fe isotopes. *Applied Isotope Geochemistry IV (2001)*, Pacific Grove, CA.
128. *J. E. Roe, A. D. Anbar and J. Barling (2001). Mechanisms of nonbiological fractionation of Fe isotopes. *European Union of Geosciences XI (2001)*, Strasbourg, France.
129. A. D. Anbar, K. J. Zahnle, G. L. Arnold and S. J. Mojzsis (2000). Extraterrestrial iridium, sediment accumulation and the habitability of the earth Earth. *2000 American Geophysical Union Fall Meeting*, San Francisco, CA. **Invited**.
130. *M. L. Polizzotto, M. Sharma and A. D. Anbar (2000). Fe isotopes in deep-sea hydrothermal fluids. *2000 American Geophysical Union Fall Meeting*, San Francisco, CA.
131. *E. S. Holman and A. D. Anbar (2000). Modeling equilibrium isotope fractionations of transition metal complexes and metal-bearing biomolecules. *2000 American Geophysical Union Fall Meeting*, San Francisco, CA.
132. A. D. Anbar, G. L. Arnold and J. Barling (2000). Molybdenum isotopes: Potential paleoredox probes? *2000 American Geophysical Union Fall Meeting*, San Francisco, CA.
133. #J. Barling, G. Ravizza, C. Tuit and A. D. Anbar (2000). Fractionation of molybdenum isotopes in Black Sea sediments. *2000 American Geophysical Union Spring Meeting*, Washington, D.C.
134. A. D. Anbar, J. E. Roe, E. S. Holman, J. Barling and C. Zhang (1999). Biotic and abiotic fractionations of iron isotopes. *1999 American Geophysical Union Fall Meeting*, San Francisco, CA.

135. A. D. Anbar and A. H. Knoll (1999). Trace Metal Limitation of Primary Production 1.85-1.25 Ga. *1999 American Geophysical Union Fall Meeting*, San Francisco, CA. **Invited**.
136. A. R. Basu, J. Barling, A. A. Smith, A. D. Anbar, and R. J. Poreda (1999). Hf, Nd, Sr, and He Isotopes in Alkali Igneous Complexes of the Deccan: Implications for the Plume Source. *1999 American Geophysical Union Fall Meeting*, San Francisco, CA.
137. A. D. Anbar, K. A. Knab, J. Barling and J. E. Roe (1999). Fractionation of transition metal stable isotopes: Toward the development of new biogeochemical tracers. *1999 Meeting of the Geological Society of America*, Denver, CO. **Invited**.
138. A. D. Anbar, C. Zhang, J. Barling, J. E. Roe and K. H. Nealson (1999). Iron isotope fractionation studies using MC-ICP-MS. *9th V. M. Goldschmidt Conference*, Cambridge, MA.
139. A. D. Anbar, G. L. Arnold, S. J. Mojzsis and K. J. Zahnle (1999). The extraterrestrial mass flux on the early Earth. *9th V. M. Goldschmidt Conference*, Cambridge, MA. **Invited**.
140. A. D. Anbar, J. Barling and J. E. Roe (1998). Application of Cu and Mo isotope fractionations to the study of life in extreme environments. *1998 American Geophysical Union Fall Meeting*, San Francisco, CA.
141. A. G. Morgan, Y. L. Yung, M. Allen, M. Carr, D. Halpern and A. D. Anbar (1998). Methyl bromide: Sources and sinks in the ocean and land. *1998 American Geophysical Union Fall Meeting*, San Francisco, CA.
142. *G. L. Arnold, A. D. Anbar and S. J. Mojzsis (1998). Iridium and platinum in early Archean metasediments: Implications for sedimentation rate and the extraterrestrial flux. *1998 Meeting of the Geological Society of America*, Toronto, Canada.
143. A. D. Anbar, J. Barling and J. E. Roe (1998). Determination of Cu and Mo isotope fractionations in natural materials using MC-IPC-MS. *8th V. M. Goldschmidt Conference*, Toulouse, France.
144. A. D. Anbar, J. Barling and J. Roe (1998). Study of Transition Metal Isotope Fractionations by MC-ICP-MS. *1998 American Geophysical Union Spring Meeting*, Boston, MA.
145. A. D. Anbar and G. J. Wasserburg (1997). Iridium in the Oceans. *7th V. M. Goldschmidt Conference*, Tucson, AZ.
146. A. D. Anbar, D. A. Papanastassiou, and G. J. Wasserburg (1996). Iridium in natural waters. *1996 American Geophysical Union Spring Meeting*, Baltimore, MD.

147. A. D. Anbar, D. A. Papanastassiou, R. A. Creaser, and G. J. Wasserburg (1994). Iridium in seawater: First observations. *1994 American Geophysical Union Spring Meeting*, Baltimore, MD.
148. Y. L. Yung and A. D. Anbar (1994). Marine CH₃Br: The effect of temperature on the ocean-atmosphere flux. *1994 American Geophysical Union Spring Meeting*, Baltimore, MD.
149. A. D. Anbar, R. A. Creaser, D. A. Papanastassiou, and G. J. Wasserburg (1992). Rhenium in seawater: Confirmation of generally conservative behavior. *1992 American Geophysical Union Fall Meeting*, San Francisco, CA.
150. A. D. Anbar, M. Allen, M-T. Leu, H. A. Nair and Y. L. Yung (1992). The impact of temperature dependent CO₂ cross section measurements: a role for heterogeneous chemistry in the atmosphere of Mars? *1992 Conference on Mars Surface and Atmosphere Through Time (MSATT)*, Kona, HI.
151. A. D. Anbar, M-T. Leu and Y. L. Yung (1991). Adsorption of HO_x on surfaces in the atmosphere of Mars. *1991 Conference of the Division of Planetary Science of the Astronomical Society*, San Francisco, CA.
152. M-T. Leu, J. Blamont, A. D. Anbar, L. F. Keyser and S. P. Sander (1991). Sticking coefficients of CO on aerosols; implications for the Martian atmosphere. *1991 American Geophysical Union Spring Meeting*, Baltimore, MD.
153. A. D. Anbar, G. A. Blake, and G. R. Rossman (1990). Nonlinear spectroscopy of silicate minerals: Hole-burning in muscovite. *1990 Pacific Conference on Chemistry and Spectroscopy*, San Francisco, CA.

Invited Presentations/Colloquia (unpublished)

1. *Searching for Life at ASU*. Spirit of the Senses (Phoenix community group). October, 2009.
2. *Follow the Elements: Astrobiology at ASU*. Canada Institute for Advanced Research (CIFAR) workshop on astrobiology, Toronto, Canada, April, 2009.
3. *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>
4. *Elements and Evolution*. School of Life Sciences Seminar Series, Arizona State University, Tempe, AZ, April, 2009.
5. *Follow the Elements: Astrobiology at ASU*. School of Earth & Space Exploration Colloquium, Tempe, AZ, January, 2009.

6. *Science & Technology Education: The University of Tomorrow?* Presentation to the American Technion Society, September, 2008.
7. *The Origin of the Earth.* Temple Emmanuel (Tempe) Science & Religion Event, May, 2008.
8. *Alternative Earths.* Presentation in the *Final Word* symposium series, ASU Kerr Cultural Center, February, 2008.
9. *Alternative Earths.* Presentation to the Humanist Society of Greater Phoenix, February, 2008.
10. *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.
11. *A Whiff of Oxygen before the Great Oxidation Event?* Department of Geological Sciences, University of Toronto, Toronto, Canada, January, 2008.
12. *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
13. *A Whiff of Oxygen before the Great Oxidation Event?* Astrobiology Seminar Series, University of Arizona, Tucson, AZ, November, 2007.
14. *Evidence for a Whiff of Oxygen before the Paleoproterozoic Great Oxidation Event.* Department of Geological Sciences, University of Michigan, Ann Arbor, MI, October, 2007.
15. *A Whiff of Oxygen before the Great Oxidation Event?* NASA Astrobiology Institute Biosignatures Workshop, Sudbury, ON, Canada, September, 2007.
16. *An Early Whiff of Oxygen and a Late Stench of Sulfide?* Department of Earth & Space Sciences, University of California, Los Angeles, May, 2007.
17. *Insights into Ocean Redox Evolution from Metals and Metal Isotopes.* Department of Geology, University of Texas, El Paso, TX, April, 2007.
18. *A Whiff of Oxygen before the Great Oxidation Event?* Department of Geoscience, University of Nevada, Las Vegas, NV, March, 2007.
19. *A Whiff of Oxygen at the Archean-Proterozoic Boundary.* School of Earth & Space Exploration Colloquium, Tempe, AZ, February, 2007.
20. *A Whiff of Oxygen at the Archean-Proterozoic Boundary.* Department of Atmospheric and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA, January, 2007.

21. *A Whiff of Oxygen before the Great Oxidation Event*. Department of Geosciences, Virginia Polytechnic Institute and State University, Blacksburg, VA, January, 2007.
22. *Alternative Life: Let's Get Elemental!* Alternative Life Workshop, ASU, December, 2006.
23. *Redox Revelations: An Early Whiff of Oxygen and a Late Stench of Sulfide?* Department of Geological and Environmental Sciences, Stanford, November, 2006.
24. *Alternative Earths*. Astrobiology Lecture Series, New Mexico Institute of Technology, October, 2006.
25. *Oxygenation of the Surface Ocean at the Archean-Proterozoic Boundary*. Astrobiology Class Lecture, New Mexico Institute of Technology, October, 2006.
26. *Drilling in Western Australia: Progress and Prospects*. Agouron Foundation Drilling Workshop, Pasadena, CA, October, 2006.
27. *The Earth through Time: The Earth's Coevolution with the Biosphere*. Pale Blue Dot III, Chicago, IL, September, 2006.
28. *The Evolution of the Earth*. Spirit of the Senses (Phoenix community group), September, 2006.
29. *Follow the Elements!* Gordon Research Conference on the Origin of Life, Lewiston, ME. July, 2006.
30. *"Non-traditional" Isotopic Biosignatures*. NRC Biosignature Workshop, Washington, DC, May, 2006.
31. *The Rise of Oxygen and the Evolution of the Metallome*. Agouron Foundation O₂ Workshop, Santa Fe, NM, April, 2006.
32. *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.
33. *Insights into Ocean Redox Evolution from Metals and Metal Isotopes*. Scripps Institute of Oceanography, March 2006.
34. *Molybdenum Isotopes as Paleoredox Proxies*. NSF Workshop on Paleoproxies, San Francisco, CA. December, 2005.
35. *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.

36. *Transition Metal Stable Isotopes*. 1st I. R. Kaplan Workshop: New Developments in Environmental Isotope Research, Hagoshrim, Israel. September, 2005.
37. *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.
38. *Environmental Geochemistry of Novel Stable Isotopes: Systematics, Surprises and Solutions*. Environmental Bioinorganic Chemistry Group, Princeton University, April, 2005.
39. *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.
40. *Testimony before the President's Commission on Implementation of U.S. Space Exploration Policy*. Public Hearing, May, 2004.
41. *Molybdenum Stable Isotopes: Observation, Interpretations and Directions*. MSA Short Course on the Geochemistry of Non-traditional Stable Isotopes, Montreal, Canada, May, 2004.
42. *Microbes and Metal Isotopes: Building a Bioinorganic Bridge*. Gordon Research Conference on Environmental Bioinorganic Chemistry, Bates College, NH, July, 2004.
43. *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.
44. *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.
45. *Molybdenum Isotopes in Biology and the Environment*. Gordon Research Conference on Molybdenum and Tungsten Enzymes, Meridan, NH. June, 2003.
46. *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.
47. *Microbes and Metal Isotopes: Building a Bioinorganic Bridge*. Department of Geology, Arizona State University. May, 2003.
48. *Good Golly, It's Moly! Insights into Ocean Chemistry and Evolution from Molybdenum and its Isotopes*. Department of Geosciences, Princeton University. March, 2003.

49. *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.
50. *Good Golly, It's Moly! Insights into Ocean Chemistry and Evolution from Molybdenum and its Isotopes*. Department of Geology, Arizona State University. February, 2003.
51. *Good Golly, It's Moly! Insights into Ocean Chemistry and Evolution from Molybdenum and its Isotopes*. USGS- Menlo Park. February, 2003.
52. *Stable Isotope Geochemistry of Transition Metals: Methods, Mechanisms and the need for Models*. Department of Geosciences, Princeton University. December, 2002.
53. *In Pursuit of Proterozoic Paleoredox: Insight from Molybdenum Isotopes*. Center for Astrobiology, University of Colorado (Boulder). October, 2002.
54. *Proterozoic Ocean Chemistry and Evolution: A Bioinorganic Bridge?* Department of Chemistry, University of Cincinnati. October, 2002.
55. *Molybdenum Isotopes: In Pursuit of Proterozoic Paleoredox*. New York Center for Studies on the Origins of Life, Rensselaer Polytechnic Institute. September, 2002.
56. *Ocean Chemistry & Evolution: Insight from Molybdenum and its Isotopes*. Dept. of Chemistry, University of Rochester. September, 2002.
57. *Molybdenum Isotopes: In Pursuit of Proterozoic Paleoredox*. Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology. April, 2002.
58. *Novel Isotopic Biosignatures: Promise and Progress*. NAI Director's Seminar Series Webcast. March, 2002.
59. *Novel Isotopic Biosignatures: Promise and Progress*. Gordon Research Conference on the Origin of Life, Ventura, CA. January, 2002.
60. *Earth, Mars and Beyond: The Search for Life in Difficult Places*. Kodak Research & Engineering Retirees Organization, Rochester, NY. January, 2002.
61. *Iron Isotopes and the Search for Life on Mars*. Department of Chemistry, Alfred College, October, 2001.
62. *Iron Isotopes and the Search for Life on Mars*. Department of Chemistry, SUNY Brockport. September, 2001.
63. *Earth, Mars and Beyond: The Search for Life in Difficult Places*. University of Rochester Alumni Association. September, 2001.

64. *Transition Metal Isotope Fractionation: Promise and Progress*. Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology. September, 2001.
65. *Transition Metal Isotope Fractionation: Promise and Progress*. Gordon Research Conference on Chemical Oceanography, Tilton, NH. August, 2001.
66. *Mission to Early Earth: Overview*. 2001 Meeting of the NASA Astrobiology Institute, Carnegie Institution of Washington. April, 2001.
67. *Iron Isotopes and the Search for Life on Mars: Promise and Progress*. Department of Geology and Geophysics, University of Minnesota. March, 2001.
68. *Molybdenum Isotopes: Potential Paleoredox Probes?* Department of Geology and Geophysics, University of Minnesota. March, 2001.
69. *Iron Isotopes and the Search for Life on Mars: Promise and Progress*. Department of Geological Sciences, University of Missouri. January, 2001.
70. *Iron Isotopes and the Search for Life on Mars: Promise and Progress*. Department of Geology, Arizona State University. October, 2000.
71. *Iron Isotopes and the Search for Life on Mars: Promise and Progress*. Department of Earth Sciences, Syracuse University. September, 2000.
72. *Iron Isotopes and the Search for Life on Mars*. Department of Chemistry, SUNY Geneseo. September, 2000.
73. *Iron Isotopes: Promise and Progress*. Department of Geophysical Sciences, University of Chicago. May, 2000.
74. *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.
75. *Fractionations of Transition Metal Stable Isotopes: Promise and Progress*. Geochemical Perspectives on Environmental Processes – 2000, Washington University. April 2000.
76. *Stable Isotope Geochemistry of Transition Metals: Iron Isotope Inferences*. Department of Geological Sciences, Cornell University. March, 2000.
77. *Stable Isotope Geochemistry of Transition Metals: Iron Isotope Inferences*. Department of Geosciences, Pennsylvania State University. March, 2000.
78. *The Search for Life: Inferences from Iron Isotopes?* Dept. of Physics, University of Rochester. January, 2000.

79. *Stable Isotope Geochemistry of Transition Metals: Iron Isotope Inferences*. Division of Geological and Planetary Sciences, California Institute of Technology. December, 1999.
80. *Life in the Geologic Record: Inferences from Iron Isotopes?* Department of Geology and Geophysics, Yale University. October, 1999.
81. *The Search for Life in Far-off Places*. Laboratory for Laser Energetics, University of Rochester. September, 1999.
82. *The Extraterrestrial Mass Flux on the Early Earth: Implications for Life*. Department of Geology and Geophysics, Yale University. April, 1999.
83. *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.
84. *Trace Element Frontiers*. Dept. of Earth and Atmospheric Sciences, University of Alberta. January, 1998.
85. *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.
86. *The Environmental Chemistry of Iridium: Providing Perspective on Dinosaur Doom*. Department of Chemistry, Canisius College. February, 1997.
87. *Trace Element Frontiers*. Dept. of Earth and Planetary Sciences, Harvard University. December, 1996.
88. *The Environmental Chemistry of Iridium: Providing Perspective on Dinosaur Doom*. Meeting of the W. New York Section of the American Chemical Society. November, 1996.
89. *Iridium in Natural Waters*. Dept. of Geology, Woods Hole Oceanographic Institution. August, 1996.
90. *Iridium in Natural Waters*. Dept. of Earth and Planetary Sciences, Harvard University. May, 1996.
91. *Iridium in Natural Waters*. Dartmouth College, Department of Earth Sciences. May, 1996.
92. *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

Pending Awards:

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

Request Amount: \$3,266,911

Period of Award: Pending (submitted 8/09)

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

Request Amount: \$733,743

Period of Award: Pending (submitted 9/09)

Source of Support: NSF OCE

Principal Investigator: A. Herrmann

Co-Principal Investigators: A. D. Anbar, L. E. Wasylenki

Project Title: Uranium isotopes in carbonate sediments: Assessing a novel paleoredox proxy

Request Amount: \$398,127

Period of Award: Pending (submitted 8/09)

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

Request Amount: \$416,757 to ASU

Period of Award: Pending (submitted 7/09)

Source of Support: NSF ATM

Principal Investigator: B. Majestic (NAU) *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?

Request Amount: \$228,770 to ASU

Period of Award: Pending (submitted 8/09)

Source of Support: NSF OCE

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

Principal Investigator: B. Majestic (NAU)

Co-Principal Investigator: P. Herckes (ASU)

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

Request Amount: \$225,202 to ASU

Period of Award: Pending (submitted 2/10)

Source of Support: NASA Exobiology

Principal Investigator: A. D. Anbar

Co-Investigators: None

Project Title: Molybdenum storage by oxygenic photoautotrophs: Adaptation to metal limitation in ancient oceans?

Award Amount: \$195,162

Period of Award: Pending (submitted 9/09)

Source of Support: NASA Exobiology

Principal Investigator: L. E. Wasylenki

Co-Investigator: A. D. Anbar

Project Title: Assessing Ni Isotope Fractionation During Abiotic Processes

Award Amount: \$438,884

Period of Award: Pending (submitted 9/09)

Source of Support: DOE

Principal Investigator: L. E. Wasylenki

Co-Investigator: A. D. Anbar

Project Title: Metal Isotopes: A New Geochemical Tool For Monitoring Contaminant Migration And Assessing Remediation

Award Amount: \$508,350

Period of Award: Pending (submitted 8/09)

Active Awards:

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 – 12/31/13

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: 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 – 6/30/11

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 – 9/30/10

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: \$109,387 to ASU
Period of Award: 4/01/08 – 3/31/11 (tentative; start not yet official)

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

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)

Expired Awards:

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: \$100,00

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 (LEnEn)
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

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

Brennecka, Gregory (Ph.D. candidate in Geological Sciences, 3rd year)
Research Area: U stable isotopes in geochemistry

Duan, Yun (Ph.D. candidate in Geological Sciences, 7th year)
Research Area: Fe and Mo isotopes in the geologic record

Glass, Jennifer (Ph.D. candidate in Geological Sciences, 4th year)
Research Area: Mo in biology and evolution

Mead, Christopher (Ph.D. candidate in Geological Sciences, 2nd year)
Research Area: Hg stable isotopes in sustainability research

Morgan, Jennifer (Ph.D. candidate in Chemistry, 5th year)
Research Area: Isotopes in biomedicine

Romaniello, Stephen (Ph.D. candidate in Geological Sciences, 2nd year)
Research Area: Biogeochemical evolution of the Earth

Staton, Sarah (Ph.D. candidate in Chemistry, 6th year; co-advised w/M. Hayes)
Research Area: High precision Fe isotope fractionation

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

Nahks Tr'Ehnl (M.S. in Geological Sciences, 3rd year)
Research Area: Variability of bioessential elements beyond the Solar System

Completed Degrees

Arnold, Gail L. (Ph.D. Geological Sciences, UR, 2004)
Research Area: Trace metals, Mo and Fe isotopes and Precambrian paleoenvironments
Present Position: Research Staff, Max Planck Institute, Bremen

Goldman, Shawn (M.S. Geological Sciences, UR, 2002)
Research Area: Fe isotope fractionation in sediments; atmosphere evolution
Present Position: Postdoctoral Scholar, University of Washington

Holman, Elizabeth S. (M.S. Geological Sciences, UR, 2001)
Research Area: Theoretical modeling of Fe isotope fractionation

Present Position: Staff, Boston Museum of Science

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

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

Present Position: Environmental Safety Officer, R. E. Ginna Nuclear Plant

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

Research Area: Mo isotope fractionation in the environment

Present Position: Ph.D. student, Geosciences, University of Maryland

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

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

Present Position: Psychology counselor, Ocean Recovery LLC.

Present Position: Unknown

Tracy Lund (M.S. in Geological Sciences, 2nd year; co-advised with Everett Shock)

Research Area: Isotope fractionation during adsorption

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

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

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

Present Position: Unknown

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

Research Area: Mo isotopes in the environment

Present Position: Unknown

Undergraduate Students (alphabetical)

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

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 expected)

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

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

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

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)
Missell, Christine (Summer Research 1999, Geology B.S. at U. Maryland, expected 2001)
Montanez, Gabriela (Senior Research, Chemical Engineering B.S., ASU, 2008 expected)
Murray, Joseph (Sophomore Research, Chemistry B.S., ASU, 2010 expected)
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 expected)
Schultz, Laura (Senior Research, Chemistry B.S., ASU, 2008)
Spaul, Hannah (Senior Research, Environmental Studies B.A., UR, 1998)
Stewart, Audrey (Laboratory Asst., Environmental Sciences B.S., UR, 2004)
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

CHM 302- Environmental Chemistry

Semesters Taught: Fall '08, '09 (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 (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.

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

Curriculum Development

School of Sustainability (SOS), 2006 - 2008

I have helped 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”). I also served as the first instructor for SOS 513 in Spring, 2008.

Curriculum Development

Dept. of Chemistry & Biochemistry, 2008 -

I am working with other faculty in the environmental/geochemistry division of the department as well as faculty on the department’s Committee on Sustainability to reinvent the Environmental Chemistry undergraduate degree program as a Sustainable Chemistry program. This effort is still in its early stages.

Honors Disciplinary Advisor

Dept. of Geological Sciences, Fall '05 – '07

Worked with faculty in the Dept. of Geological Sciences 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.