

# CURRICULUM VITAE

## Robert E. Kopp

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### RESEARCH INTERESTS

- Earth history, especially the evolution of global biogeochemical cycles and paleoclimate, and its implications for future changes to Earth systems
- The taphonomy of magnetotactic bacteria and the effects of diagenesis on the magnetic properties of sediments
- The development of environmental magnetic techniques and related geophysical techniques, such as ferromagnetic resonance spectroscopy, as tools for studying Earth system processes and Earth history through the window of iron mineralogy

### EDUCATION

**Ph.D. in Geobiology, California Institute of Technology, Pasadena, California** June 2007  
*Thesis:* The Identification and Interpretation of Microbial Biogeomagnetism  
*Research Advisor:* Dr. Joseph L. Kirschvink

**M.S. in Geobiology, California Institute of Technology, Pasadena, California** June 2005

**Student, Agouaron Geobiology Summer Course, USC Wrigley Institute, Catalina Isl., California** July 2004

**S.B. in Geophysical Sciences, University of Chicago, Chicago, Illinois** June 2002  
*General and Departmental Honors*  
*Senior thesis:* "Evidence for Antarctic Alteration of Martian Meteorite ALH84001"  
*Research Advisor:* Dr. Munir Humayun

### HONORS AND AWARDS

Harrison Brown Memorial Moore Graduate Research Fellow, California Institute of Technology 2002-2006  
National Science Foundation Graduate Research Fellow 2002-2005  
Prize for Excellence, Sigma Xi (University of Chicago chapter) 2002  
Student Marshall, University of Chicago Class of 2002 2001-2002  
Elected to Phi Beta Kappa 2001

### RESEARCH EXPERIENCE

**STEP Postdoctoral Fellow, Princeton University, Princeton, New Jersey** 2007-  
Conducting research directed toward the understanding of paleoclimatic analogs for Earth's future, anthropogenically-perturbed climate. Toward that end, I am reanalyzing sea-level records from Pleistocene interglacial periods and using geochemical and environmental magnetic techniques to construct high-resolution climate records from the early Eocene Hothouse. I am also continuing studies of the magnetofossil proxy for paleo-redox conditions.

**Research Fellow, California Institute of Technology, Pasadena, California** 2002-2007  
Conducted research directed toward the long-term goal of constructing a deep-time magnetofossil record to provide a new window on the evolution of planetary redox conditions. Toward that end, I developed ferromagnetic resonance spectroscopy (FMR) as a tool for distinguishing magnetite produced by magnetotactic bacteria from other sources of magnetite and applied FMR, rock magnetism, electron microscopy, and computational modeling to experimental studies of the taphonomy of magnetotactic bacteria and to studies of environmental and rock samples.

**Research Assistant, University of Chicago, Chicago, Illinois** 1999-2002  
 Conducted petrographic and kinetic modeling studies to test the hypothesis of Antarctic contamination of the Martian meteorite ALH84001. Analyzed the trace element composition of carbonate samples with ICP mass spectrometry.

## TEACHING EXPERIENCE

**Teaching Assistant, California Institute of Technology, Pasadena, California** 2003-2006  
 Teaching assistant for the introductory Earth history class *Earth and Biosphere* and its graduate-level counterpart *Introduction to Geobiology* (instructor: Joseph Kirschvink), winter 2005 and 2006 led redesign of readings, homeworks, and laboratories exercises, and coordinated four-day field trips to Baja California. Teaching assistant for *Paleomagnetism and Magnetostratigraphy* (instructor: Joseph Kirschvink), spring 2005. Teaching assistant for *Methods in Applied Statistics and Data Analysis* (instructor: Tapio Schneider), fall 2003.

**Field Trip Coordinator, California Institute of Technology, Pasadena, California** 2004-2005  
 Coordinated weekend field trip classes led by Dr. Joseph Kirschvink in 2004 and 2005 to southwestern Utah and the Colorado Plateau. Co-coordinated two-week summer field trips to Western Australia in 2004 and to Grand Teton National Park, Yellowstone National Park, and the Beartooth Range in 2005.

## SELECTED FIELD EXPERIENCE

**British Columbia, Canada, August 2007** Ten days of sedimentological characterization and geochemical and environmental magnetic samples of predominantly lacustrine early Eocene sediments of the Thompson and Okangan valleys, with Adam Maloof (Princeton).

**Andros Island, Bahamas, December 2005** One week of environmental magnetic and sedimentological coring of modern carbonate sediments of Three Creeks region, with Adam Maloof (Princeton), David Fike (Caltech), and Tanja Bosak (Harvard).

**Ontario, Canada, August 2005** One week of geobiological sampling in the Paleoproterozoic Gunflint Formation, with Ryan Petterson (Caltech) and Nicola McLoughlin (Oxford).

**South Africa, September 2002** Three weeks of ground work for the Agouron Institute Geobiology Drilling Project through the late Archean and Paleoproterozoic of the Kaapvaal Craton, and paleomagnetic sampling of Permo-Triassic sediments of the Karoo, with Joseph Kirschvink (Caltech), Michiel de Kock (University of Johannesburg), and colleagues from the University of Tokyo.

**Ontario/Quebec, Canada, June 2002** One week of paleomagnetic sampling in Paleoproterozoic Huronian Supergroup, with Joseph Kirschvink (Caltech) and colleagues from the University of Tokyo.

## ACADEMIC SERVICE

**Session Convener, “Biogeomagnetism: Processes and Products”** Dec. 2005  
 American Geophysical Union Fall Meeting, San Francisco, CA

**Secretary, Graduate Student Council, California Institute of Technology, Pasadena, CA** 2005-2006  
 Served as at-large representative to and secretary for the Caltech graduate student government.

**Committee Member, Caltech Y Social Activism Speakers Series, Pasadena, CA** 2004-2006  
 Participated in selection and hosting of speakers and in the planning, advertising, and running of events. Speakers included author Chris Mooney, Union of Concerned Scientists president Kurt Gottfried, and civil rights activist/poet Nikki Giovanni. Also co-organized a pre-election forum with Caltech faculty on science and policy in October 2004.

**Member:** American Geophysical Union, Geological Society of America, and American Association for the Advancement of Science.

## POLITICAL EXPERIENCE

**Technology Chair, Pasadena Young Democrats, Pasadena, CA** 2005-2007  
 Volunteered extensively for Adam Murray’s 2006 Assembly campaign. Co-organized Meet Your Elected Officials events and 2006 Assembly candidate forum. Redesignated and maintained Pasadena Young Democrats web page using CivicSpace software.

**President, Caltech Democratic Club, Pasadena, CA** 2004-2007  
Involved in established a foothold for Democratic politics and the John Kerry for President campaign on the Caltech campus. Organized Presidential debate and State of the Union watch parties, which attracted 40-100 participants (on a campus with about 2000 students).

**President, Caltech Students for Dean, Pasadena, CA** 2003-2004  
Organized Caltech students' participation in Howard Dean's presidential campaign through Meetups, flyering, and precinct walking.

## PEER-REVIEWED PUBLICATIONS

- S. M. Tikoo, R. E. Kopp, H. Vali, T. D. Raub, C. Z. Nash, and J. L. Kirschvink (in prep). Testing for the presence of vertical redox gradients in the late Archean ocean: a search for bacterial magnetofossils. *Precamb. Res.*
- J. L. Kirschvink and R. E. Kopp (in rev). Paleoproterozoic Global Glaciation and the Evolution of Oxygen Mediating Enzymes: The Case for a Late Origin of Photosystem-II. *Proc. Royal Soc. B.*
- J. L. Kirschvink, R. E. Kopp, T. D. Raub, C. T. Baumgartner, and J. W. Holt (in rev). Rapid, precise, and high-sensitivity acquisition of paleomagnetic and rock magnetic data: Development of a low-noise automatic sample changing system for superconducting rock magnetometers. *Geochem. Geophys. Geosys.*
- R. E. Kopp and J. L. Kirschvink (2007). The identification and biogeochemical interpretation of fossil magnetotactic bacteria. *Earth Sci. Rev.* doi:10.1016/j.earscirev.2007.08.001
- R. E. Kopp, T. D. Raub, D. Schumann, H. Vali, A. V. Smirnov, and J. L. Kirschvink (2007). Magnetofossil Spike During the Paleocene-Eocene Thermal Maximum: Ferromagnetic Resonance, Rock Magnetic, and Electron Microscopy Evidence from Ancora, New Jersey, USA. *Paleoceanography* 22: PA4103, doi:10.1029/2007PA001473
- A. C. Maloof, R. E. Kopp, J. P. Grotzinger, D. A. Fike, T. Bosak, H. Vali, P. M. Poussart, B. P. Weiss, and J. L. Kirschvink (2007). Sedimentary Iron Cycling and the Origin and Preservation of Magnetization in Platformal Carbonate Muds, Andros Island, the Bahamas. *Earth Planet. Sci. Lett.* 259: 581-598.
- R. E. Kopp, C. Z. Nash, A. Kobayashi, B. P. Weiss, D. A. Bazylinski, and J. L. Kirschvink (2006). Ferromagnetic resonance spectroscopy for assessment of magnetic anisotropy and magnetostatic interactions: a case study of mutant magnetotactic bacteria. *J. Geophys. Res. B.* 111, B12S25.
- M. Liang, H. Hartman, R. E. Kopp, J. L. Kirschvink, and Y. L. Yung (2006). Production of oxidants in the atmosphere of a Snowball Earth: implication for the origin of oxygenic photosynthesis. *Proc. Natl. Acad. Sci.* 103: 18896-18899.
- R. E. Kopp, B. P. Weiss, A. C. Maloof, H. Vali, C. Z. Nash, and J. L. Kirschvink (2006). Chains, clumps, and strings: magnetofossil taphonomy with ferromagnetic resonance spectroscopy. *Earth Planet. Sci. Lett.* 247: 10-25.
- A. Kobayashi, J. L. Kirschvink, C. Z. Nash, R. E. Kopp, D. A. Sauer, L. E. Bertani, W. F. Voorhout, and T. Taguchi. (2006). Experimental observation of magnetosome chain collapse in magnetotactic bacteria: Sedimentological, paleontological, and evolutionary implications. *Earth Planet. Sci. Lett.* 245: 538-550.
- Y. Suzuki, R. E. Kopp, *et al.* (2006). Sclerite formation in the hydrothermal-vent "scaly-foot" gastropod -- possible control of iron sulfide biomineralization by the animal. *Earth Planet. Sci. Lett.* 242: 39-50.
- R. E. Kopp, J. L. Kirschvink, I. A. Hilburn, and C. Z. Nash (2005). The Paleoproterozoic Snowball Earth: A climate disaster triggered by the evolution of oxygenic photosynthesis. *Proc. Natl. Acad. Sci.* 102: 11131-11136.
- B.P. Weiss, S.S. Kim, J.L. Kirschvink, R.E. Kopp, M. Sankaran, A. Kobayashi, and A. Komeili (2004). Ferromagnetic resonance and low-temperature magnetic tests for biogenic magnetite. *Earth Planet. Sci. Lett.* 224: 73-89.
- B.P. Weiss, S.S. Kim, J.L. Kirschvink, R.E. Kopp, M. Sankaran, A. Kobayashi, and A. Komeili (2004). Magnetic tests for magnetosome chains in Martian meteorite ALH84001. *Proc. Natl. Acad. Sci.* 101: 8281-4.
- R.E. Kopp and M. Humayun (2003). Kinetic model of carbonate dissolution in Martian meteorite ALH84001. *Geochim. Cosmochim. Acta* 67, 3247-3256.

## POPULAR PUBLICATIONS

- Geology reader for S. Darksyde and M. Sumner (2006). *Kosmos: You are Here*. YearlyKos.org. Electronic book. <http://www.dailykos.com/storyonly/2006/5/1/63150/18071>
- Ghostwriter for J. L. Kirschvink (2006). Red Earth, White Earth, Green Earth, Black Earth. *Engineering & Science* No. 4: 10-20.

R. E. Kopp and J. L. Kirschvink (2004). The world's worst climate disaster. In: *Miracle Planet II: The Evolution of Our World*. Tokyo: NHK (Japan Broadcasting Corporation). [published in Japanese]

## PRESENTATIONS AND ABSTRACTS

(Invited talks are indicated by an \*)

- R. E. Kopp and J. L. Kirschvink (2007). A scoring scheme for evaluating magnetofossil identifications. American Geophysical Union Fall Meeting, San Francisco, CA, December 2007.
- S. M. Tikoo, R. E. Kopp, A. V. Smirnov, T. D. Raub, D. Schumann, H. Vali, and J. L. Kirschvink (2007). Testing the Paleocene-Eocene Thermal Maximum Magnetofossil Spike Hypothesis. American Geophysical Union Fall Meeting, San Francisco, CA, December 2007.
- D. Schumann, T. D. Raub, R. E. Kopp, S. M. Tikoo, S. K. Sears, U. Leucken, I. Rouiller, A. V. Smirnov, J. L. Kirschvink, and H. Vali (2007). Possible Eukaryotic Magnetite in the Paleocene-Eocene Boundary Clay, Ancora, New Jersey. American Geophysical Union Fall Meeting, San Francisco, CA, December 2007.
- R. E. Kopp, T. D. Raub, D. Schumann, H. Vali, A. V. Smirnov, and J. L. Kirschvink (2007). Magnetofossil spike during the Paleocene-Eocene Thermal Maximum: Ferromagnetic resonance, rock magnetic, and electron microscopy evidence from the Atlantic Coastal Plain of New Jersey. Geological Society of America Annual Meeting, Denver, CO, Paper 183-11, October 2007.
- \* R. E. Kopp, A. C. Maloof, B. P. Weiss, and J. L. Kirschvink (2006). Assessing the source of magnetization in sediments with rock magnetism and ferromagnetic resonance spectroscopy. Geological Society of America Annual Meeting, Philadelphia, PA, Paper No. 164-6, October 2006.
- A. C. Maloof, R. E. Kopp, J. P. Grotzinger, B. P. Weiss, H. Vali, and J. L. Kirschvink (2006). The origin and preservation of magnetization in platformal carbonate muds, Andros Island, Bahamas. Geological Society of America Annual Meeting, Philadelphia, PA, Paper No. 164-7, October 2006
- \* R. E. Kopp, C. Z. Nash, B. P. Weiss, A. C. Maloof, A. Kobayashi, H. Vali, and J. L. Kirschvink (2006). Identifying magnetotactic bacteria and their fossils with ferromagnetic resonance. Goldschmidt Conference, Melbourne, Australia, Abstract No. 206.00, August 2006.
- \* R. E. Kopp, C. Z. Nash, B. P. Weiss, A. C. Maloof, A. Kobayashi, H. Vali, and J. L. Kirschvink (2006). Identifying magnetotactic bacteria and their fossils with ferromagnetic resonance. Southern California Geobiology Symposium, Riverside, CA, April 2006.
- R. E. Kopp, B. P. Weiss, J. L. Kirschvink, C. Z. Nash, and A. C. Maloof (2006). Fossil magnetotactic bacteria: an iron biosignature. Astrobiology Science Conference, Washington, DC, Astrobiology 6(1), Abstract 20, March 2006.
- R. E. Kopp, J. L. Kirschvink, B. P. Weiss, and A. C. Maloof (2005). Identification of magnetosome chains by ferromagnetic resonance spectroscopy. American Geophysical Union Fall Meeting, San Francisco, CA, *Eos Trans. AGU* 86(52), Fall Meet. Suppl., Abstract B24A-03, December 2005.
- A. C. Maloof, J. P. Grotzinger, R. E. Kopp, B. P. Weiss, H. Vali, and J. L. Kirschvink (2005). On the origin of magnetization in platformal carbonate muds. American Geophysical Union Fall Meeting, San Francisco, CA, *Eos Trans. AGU* 86(52), Fall Meet. Suppl., Abstract B24A-07, December 2005
- J. L. Kirschvink and R. E. Kopp (2005). A Paleoproterozoic origin of oxygenic photosynthesis as a trigger for the Makganyene Snowball Earth. Earth System Processes 2, Calgary, Alberta, Canada, Paper No. 11-7, August 2005.
- R. E. Kopp, J. L. Kirschvink, and B. P. Weiss (2005). Magnetofossils as a novel tracer of ancient microbial communities and environments. Southern California Geobiology Symposium, Los Angeles, CA, April 2005
- R. E. Kopp, C. Z. Nash, J. L. Kirschvink, and J. R. Leadbetter (2004). A possible magnetite/maghemite battery in the magnetotactic bacteria. American Geophysical Union Fall Meeting, San Francisco, CA, *Eos Trans. AGU* 85(47), Fall Meet. Suppl., Abstract GP34A-06, December 2004.
- \* R. E. Kopp, B. P. Weiss, S. S. Kim, and J. L. Kirschvink (2004). Ferromagnetic resonance spectroscopy in the hunt for magnetofossils. Institute for Rock Magnetism Santa Fe 6, Santa Fe, NM, June 2004.
- R. E. Kopp, C. Z. Nash, and J. L. Kirschvink (2004). Magnetosome batteries, magnetofossils, and the evolution of the planetary redox state. Southern California Geobiology Symposium, Pasadena, CA, February 2004
- \* R. E. Kopp, J. L. Kirschvink, D. K. Newman, C. Z. Nash, and I. A. Hilburn (2003). Bacterial Bolsheviks: PS II and the evolution of the oxygenic revolution. American Geophysical Union Fall Meeting, San Francisco, CA, *Eos Trans. AGU* 84(46), Fall Meet. Suppl., Abstract U52B-07, December 2003.