TANJA BOSAK

Curriculum Vitae

Department of Earth, Atmospheric and Planetary Sciences
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Degrees

Ph.D., Geobiology, California Institute of Technology Advisor: Dianne K. Newman	2004
B.S., Geophysics, Zagreb University	1998

Employment

Associate Professor of Geobiology, Massachusetts Institute of Technology	2012-present
Cecil and Ida Green Assistant Professor of Geobiology, Massachusetts Institute of Technology	2007-2012
Postdoctoral Researcher: Microbial Sciences Initiative, Harvard University, Supervisors: Ann Pearson and Richard Losick	2004-2007
Meteorologist, Zagreb International Airport	1999

Honors

Investigator, Simons Collaboration on Origins of Life	2014-present
Hayes Career Development Chair, MIT	2013
UROP Faculty Mentor of the Year, MIT	2012
The Harold E. Edgerton Award for outstanding achievement in research, teaching, and service to the MIT community (given yearly to one untenured faculty member)	2012
AGU Fellow, American Geophysical Union	2011
AGU James B. Macelwane Medalist, American Geophysical Union	2011
Solomon J. Buschbaum Faculty Initiatives Fund Award, MIT	2009
Cecil and Ida Green Career Development Chair, MIT	2007
The Subaru Outstanding Woman in Science Award, Geological Society of America	2007
Invited Participant in Chinese-American Frontiers of Sciences Symposium, the United States National Academy of Sciences and the Chinese Academy of Sciences	2005-2006
Microbial Sciences Initiative Fellow, Harvard University	2005-2007
Everhart Distinguished Graduate Student Lecturer Award, California Institute of Technology	2004
Student Travel Grant for Short Course in Biomineralization, American Mineralogical Society	2003
Student Travel Award, American Society of Microbiology	2003
Summer Undergraduate Research Fellowship, California Institute of Technology	1998
The Award of the Dean of Studies, Faculty of Natural Sciences, Zagreb, Croatia	1998

Undergraduate Research Students Supervised

Diana LaScala-Grunewald, Fall 2007-Spring 2009, in graduate school
Kristen Whaley, Spring 2008
Anastasia Maheras, Summer 2008
Jose L. O. Lugo, University of Puerto Rico, Summer 2008, in graduate school
Joan Chen, Fall 2008, Spring 2009
Barry D. Bannon, Spring 2009-Spring 2010
Kevin Gildea, Spring 2010
Matthew Archer, Spring 2010, Summer 2010
John Bardeen, Spring 2010
Lilly Dalton, Smith College, Summer 2010
Eileen Molzberger, University of Wisconsin, Summer 2010, 2011, in graduate school
Emily Chen, Summer 2010
Rachel Harris, Wellesley College, Summer 2011
Duane Dennis, Fall 2011, Spring 2012
Madeleine O'Grady, Summer 2013
Camila Ramirez-Arau, Summer 2013
Ciara Gomez, Fall 2013
Rachel Harris, Wellesley College, Spring 2014
Erin Reynolds, Summer 2014

Ph.D. Students Supervised

Petroff, Alexander, thesis title "Streams, stromatolites, and the geometry of growth", co-advised with D. Rothman (EAPS), defended in May 2011, Postdoctoral Fellow at The Center for Studies in Physics and Biology at The Rockefeller University

Sim, Min Sub, thesis title "Physiology of multiple sulfur isotope fractionation during microbial sulfate reduction", co-advised with S. Ono (EAPS), defended in May 2012, Agouron Postdoctoral Fellow at Caltech

Antler, Gilad, third year graduate student at Cambridge University, UK, co-advised with S. Turchyn (Cambridge), S. Ono (EAPS) and O. Sivan (Ben-Gurion University)

Yi, Robert, fourth year graduate student at MIT, advisor on a project

Wang, David, fourth year graduate student at WHOI, advisor on a first-year project

Evans, Alex, secondary advisor, Ph.D. in Planetary Sciences and M. Sci. in Geobiology, MIT, September 2013

Matys, Emily, third year graduate student at MIT, advisor on a project

Newman, Sharon, third year graduate student at MIT, primary advisor

Postdoctoral Researchers Supervised

Zaarur, Shikma	2014-present
Shubotz, Florence, advisor on a project	2013-2014
Mariotti, Giulio, Crosby postdoctoral fellow in EAPS, assistant professor, Louisiana State University starting in January 2015	2013-present
Cohen, Phoebe, assistant professor, Williams College, MA	2012
Templer, Stefanie, unit leader at Roche, Switzerland	2009-2010
Liang, Biqing, assistant professor, National Cheng Kung University, Taiwan	2008-2010

Teaching Experience

12.007 Geobiology, Spring 2008, 2009, 2010, 2011, 2012, 2013, 2014
12.080 EAPS Undergraduate Seminar, Spring 2011
12.A60 Freshman Seminar, Fall 2013
12.420 Recitation Instructor for Physics and Chemistry of the Solar System, Spring 2009
12.601 Essentials: Planetary Science, Spring 2009
12.490 Microbial Sediments, Fall 2009
12.092 Seminar in Geobiology and Astrobiology (undergraduate), Fall 2008
12.490 Seminar in Geobiology and Astrobiology (graduate), Fall 2008
12.491 Advanced Seminar in Geology and Geochemistry, Fall 2011
12.471 Essentials of Geobiology (graduate), Fall 2012, 2013

Service

Internal to MIT

EAPS Space Feasibility Study	2013-2014
Freshman advisor	2013-present
EAPS *ad hoc* visioning committee	2013
Hooding ceremony	2012
Speaker in a workshop of high school teachers run by HHMI, MIT	2011
Host to a high school teacher intern through HHMI	2010
Foreign Scholarships Committee	2008-present
EAPS Undergraduate Committee	2007-present
Thesis advisory committee: four WHOI students, three EAPS students	2007-present
Generals examination committee: twelve MIT and WHOI students	2007-present
Thesis defense committee: two WHOI students, four EAPS students	2007-present
Hooding ceremony	2011
Graduate Women and MIT mentor	2010-present

External Service

Co-chair, the Gordon Geobiology Conference	2016
Host to a hands-on lab visit by 35 students from Weston Middle School (Weston, MA)	May, 2014
Host to a high school research student from Cambridge Rindge and Latin High School (Cambridge, MA), November 2013 – January 2014	
Editor, Chapter 10, Microbial formation and degradation of carbonates, the 6th edition of Geomicrobiology, D. K. Newman and H. L. Ehrlich, *eds*.	2013
The Geochemical Society selection committee for best paper in organic Geochemistry	2013-2014
AGU Fellows Committee member	2013-2014
Session convener, Astrobiology Science Conference, Atlanta, GA	2012
NOVA Science Café Speaker, Cambridge, MA	2012
Member of the review editorial board for Frontiers in Microbiological Chemistry	2011-
Session Convener, "Taphonomy and Organic Geochemistry", V. M. Goldschmidt Conference, Prague, Chech Republic	2011
Session Convener and Chairwoman, "Geomicrobiology and Fossil Biosignatures",	

V. M. Goldschmidt Conference, Davos, Switzerland 2009
Speaker, Girls' Angle, math club for girls 8-13 years old, Cambridge, MA February 2009
Referee, *Applied and Environmental Microbiology, Astrobiology, Chemical Geology, Earth and Planetary Science Letters, Geobiology, Geology, Journal of Bacteriology, Journal of the Royal Society Interface, Journal of Sedimentary Research, Palaios, Science, Nature Scientific Reports, Sedimentology, Geochimica and Cosmochimica Acta, Terra Nova, ISME Journal*
Science Review Panel, NASA Exobiology Program 2008
External Reviewer: NSF Geobiology and Low-Temperature Geochemistry, NASA Exobiology, NSF Sedimentary Geology and Paleontology, NASA Astrobiology
Lecturer, Program in Astrophysics at the Department of Physics, Split, Croatia, 2008
Member of the editorial board of *Geobiology*, 2008-
Speaker at the Geological Society of America mentoring program for women in geology, Denver, CO 2007
Member of the Organizing Committee of Chinese-American Frontiers of Sciences Symposium 2006-2007

Invited Presentations

"Isotopic and lipid signatures of microbial sulfate reduction", The Geophysical Laboratory, Washington D.C., November 2014
"Isotopic and lipid signatures of microbial sulfate reduction", Department of Microbial and Plant Biology, University of California, Berkeley, CA, October 2014
"Wrinkle structures and linear trails produced by moving microbial aggregates", Geological Society of America Fall Meeting, Vancouver, Canada, October 2014
"Microbial landscapes", Department of Geosciences, Stanford University, Palo Alto, CA, October 2014
"Microbial landscapes", Department of Geosciences, ETH, Zürich, Switzerland, September 2014
Tech Day, MIT, June 2014
Big Ideas for Busy People, Cambridge Science Festival, Cambridge MA, April 2014
"Microbial landscapes", Department of Geosciences, Princeton University, Princeton, March 2014
"The meaning of stromatolites", Department of Earth and Environmental Science, University of Pennsylvania, Philadelphia, March 2014
"Microbial sedimentology of stromatolites in Neoproterozoic cap carbonates", Paleontological Society Short Course, Denver, October 2013, *invited talk*
"The meaning of stromatolites", SUM 2013 Workshop, University of Science and Technology of China, Hefei, September 2013, *invited talk*
"The meaning of stromatolites", Origins of Life symposium at the Max Plank Institute, Dresden, July 2013, *invited talk*
"The meaning of stromatolites", University of California, Berkeley, May 2013
"Records of early metabolisms and biological evolution in stromatolites", Geological Association of Canada Annual Meeting, May 2012, St. John's, Canada, *invited talk*
"Stromatolites and biofilms", "Celebrating a dynamic planet", the Kongsberg seminar, Kongsberg, Norway, May 2012, *invited talk*

"Signs of photosynthesis on the Early Earth", NASA Astrobiology Science Conference, April 2012, Atlanta, GA, *invited talk*

"The meaning of stromatolites", Department of the Geophysical Sciences, University of Chicago, February 2012

"Towards a theory of stromatolites", "Unique opportunities in Geobiology" symposium of the International GeoBiology Summer Course, Golden, CO, 2011

"Modern eukaryotes between the two Snowballs", annual meeting of the NASA Astrobiology Institute team, MIT, Cambridge, MA, 2011

"Towards a theory of stromatolites", Department of Geology and Geophysics, Yale University, 2011

"Towards a theory of stromatolites", a series of three lectures at Petrobras, Rio de Janeiro, Brazil, 2011

"What they eat is how they fractionate: controls on sulfur isotope fractionations during microbial sulfate reduction in culture and nature", *invited talk,* AGU Fall Meeting, San Francisco, CA, 2010

"Evolution of modern eukaryotes and the Cryogenian global changes", *invited talk,* AGU Fall Meeting, San Francisco, CA, 2010

"Life between the Snowballs", Department of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA, 2010

"Life between the Snowballs", Program in Organismic and Evolutionary Biology, University of Massachusetts, Amherst, MA, 2010

"Evolution of photosynthesis", Science for the Public televised seminar series, 2010

"Life between the Snowballs", Microbial Science Initiative Seminar Series, Harvard University, Cambridge, MA, 2010

"Growth geometry of modern conical stromatolites", Goldschmidt Conference, Knoxville, TN, 2010

"Life between the two Snowballs", annual geobiology symposium "Advent of Complex Life and the Neoproterozoic-Cambrian transition", Harvard University, Cambridge MA, 2010

"Growth geometry of modern and ancient photosynthetic biofilms"
Earth System Initiative Young Faculty Talk Series, MIT, 2010

"Surviving the Snowball", MIT alumni breakfast, 2009

"Growth geometry of modern sedimentary structures", OEB and EPS, Harvard University, 2009

"The evolution of photosynthesis", MIT Darwin Bicentennial Symposium, 2009

"Conical stromatolites as records of microbial processes", Department of Environmental Sciences and Engineering, MIT, 2008

"Zivot na mladom planetu", popular science lecture, Split, Croatia, 200

"What do geostable lipids do in modern bacteria?", Faculty of Physics,University of Split, Croatia, 2008

"What do geostable lipids do in modern bacteria?", Chemical Oceanography Seminar Series, Woods Hole Oceanographic Institute, Woods Hole, MA, 2008

" Conical stromatolites as records of microbial processes", Department of Earth Sciences, University of California, Santa Cruz, CA, 2008

"Conical stromatolites as records of microbial processes", Department of Geosciences, Princeton University, Princeton, NJ, 2008

"Morphology of microbial aggregates as a biomarker", Plenary Session, NASA Astrobiology Science Conference, San Jose, CA, 2008

"What do geostable lipids do in modern bacteria?", Faculty of Geosciences,University of Tübingen, Tübingen, Germany, 2007

"Stromatolites as records of early life on Earth", Department of Earth Sciences, University of Washington, Seattle, WA, 2006

"What do polycyclic terpenoids do in modern bacteria?", Department of Earth Sciences, University of Washington, Seattle, WA, 2006

"Stromatolites as records of early life on Earth", Department of Earth, Atmospheric and Planetary Sciences, MIT, 2006

"What do polycyclic terpenoids do in modern bacteria?", Department of Earth, Atmospheric and Planetary Sciences, MIT, 2006

"Stromatolites as records of early life on Earth", Department of Geosciences, Dartmouth College, Hanover, NH, 2006

"What do polycyclic terpenoids do in modern bacteria?", Department of Geosciences, Dartmouth College, Hanover, NH, 2006

"Laboratory models of ancient stromatolites", Everhart Lecture, California Institute of Technology, Pasadena, CA, 2005

"Laboratory models of ancient stromatolites", Department of Geology and Geophysics, Yale University, New Haven, CT, 2005

"Finding microbial imprints in the Precambrian stromatolites", mini-symposium, Geobiology Summer Course, Agouron Institute and USC, Bozeman, MT, 2003

Publications

Asterisk * indicates work produced in my lab, diamond ◊ indicates graduate students and postdocs from my lab, [u] indicates undergraduates.

*◊Mariotti, G., Pruss, S. B., Summons, R. E., Newman, S., Klepac-Ceraj, V., and *Bosak, T.*, Where is the ooid factory?, *submitted*.

Lahr, D. J. G., *Bosak, T.*, Lara, E., Mitchell, E. A. D., Phanerozoic diversification of silica-cycling testate amoebae and the strengthened coupling of terrestrial C and Si cycles, *submitted*.

*◊Mariotti, G., Pruss, S. B., [u]Ai, X. and *Bosak, T.* An alternative origin for early animal trace fossils, *submitted*.

McNeil, D., Shulze, H. G., ◊Matys, E. D., and *Bosak, T.* Raman spectroscopic analysis of carbonaceous matter and silica in the test walls of recent and fossil agglutinated foraminifera, AAPG Bulletin, *in press*.

Ono, S., Sim, M. S., and *Bosak, T.* (2014) Predictive isotope model connects microbes in culture and nature, *Proceedings of the National Academy of Sciences of the U.S.A.*, doi: 10.1073/pnas.1420670111.

*◊Cohen, P.A., Macdonald, F.A., Pruss, S.B., ◊Matys, E.D., and *Bosak, T.* Fossils of putative marine algae from the Cryogenian glacial interlude of Mongolia, *Palaios*, *in press*.

*◊Mariotti, G., Pruss, S. B., Perron, T. and *Bosak, T.* (2014) Microbial shaping of sedimentary wrinkle structures, *Nature Geoscience,* doi:10.1038/ngeo2229.

*◊Mariotti, G., Perron, T. and *Bosak, T.* (2014) Elongation of stromatolites through feedbacks between flow, sediment motion and microbial growth on sand bars, *EPSL*, **397**, 93-100.

*◊Liang, B., Wu, T.D., Guerquin-Kern, J.L., Vali, H., Sun, H.-J., ◊Sim, M. S., Wang, C.-H., *Bosak, T.* (2014) Cyanophycin mediates the accumulation and storage of carbon in non-heterocystous filamentous cyanobacteria from coniform mats, *PloS One*, DOI: 10.1371/journal.pone.008814.

[◊]Meredith, L.K., [u]Rao, D., *Bosak, T.*, Hansell, C.M., Ono, S., Prinn, R.G. (2013) Consumption of atmospheric H_2 during the life cycle of soil-dwelling Actinobacteria, Environmental Microbiology Reports.

[*◊]Petroff, A.P.P., Rothman, D.H., Beukes, N., and *T. Bosak* (2013) Biofilm growth and fossil form, *Physical Review X*, **3**, 041012.

[*]*Bosak, T.*, [◊]Mariotti, G., Perron, J.T., Macdonald, F.A., Pruss, S.B. Microbial sedimentology of stromatolites in the Neoproterozoic cap carbonates (2013) Ecosystems Paleobiology and Geobiology, *Paleontological Special Papers*, **19**, The Paleontological Society, 51-75.

[*◊]Sim, M.S., [◊]Wang, D.T., Semkiw, E. S., Zane, G.M., Wall, J.D., *Bosak, T.* and S. Ono (2013) Fractionation of sulfur isotopes by *Desulfovibrio vulgaris* mutants lacking hydrogenases or type I tetraheme cytochrome c3, *Frontiers in Microbiology*, **4**: doi: 10.3389/fmicb.2013.00171.

[*]*Bosak, T.*, Knoll, A. H., and [◊]A.P.P. Petroff (2013) The meaning of stromatolites, *Annual Reviews of Earth and Planetary Sciences*, **41**, 21-44.

[*,u]Dalton, L., *Bosak, T.*, Macdonald, F.A., Lahr, D.G., and S.B. Pruss (2013) Preservational and morphological variability of assemblages of agglutinated eukaryotes in cap carbonates of the Rasthof Formation, northern Namibia, *Palaios*, **28**, 67–79.

[*◊]Sim, M. S., [◊]Liang, B., [◊]Petroff, A. P., [◊]Evans, A., Klepac-Ceraj, V., Walter, M.R., Flannery, D.T., and *T. Bosak* (2012) Oxygen-dependent morphogenesis of modern clumped photosynthetic mats and implications for the Archean stromatolite record, *Geosciences*, http://www.mdpi.com/2076-3263/2/4/235

[*◊]Sim, M.S., *Bosak, T.*, and S. Ono (2012) Effects of iron and nitrogen limitation on sulfur isotope fractionation during microbial sulfate reduction, *Applied and Environmental Microbiology*, **78**, 8368-8376.

Bosak, T.*, [◊]Templer, S., Wu, T.-D., [◊]Liang, B., Guerquin Kern, J.-L., Mui, J., Vali, H., [◊]Evans, A., [◊]Sim M. S., Friedman, J., and V. Klepac-Ceraj. (2012) Cyanobacterial composition and activity in modern conical microbialites, *Geobiology*, **10, 384-401.

[*]*Bosak, T.*, Lahr D.J.G., Pruss, S. B., Macdonald, F.A., Gooday, A.J., Dalton, L., [◊]Matys, E.D. (2012) Possible early foraminiferans in post-Sturtian (716-635 Ma) cap carbonates, *Geology*, **40**, 47-50.

*[◊]Petroff, A.P.P., Wu, T-D., [◊]Liang, B., Mui, J., Guerquin-Kern, J.-L., Vali, H., Rothman, D.H., and *T. Bosak* (2011) Reaction-diffusion model of nutrient uptake in a biofilm: theory and experiment, *Journal of Theoretical Biology*, **289**, 90-95.

Bosak, T.*, Lahr, D., Macdonald, F.A, [◊]Matys, E.D. (2011) Putative Cryogenian ciliate from Mongolia, *Geology*, **39, 1123-1126.

*[◊]Sim, M.S., *Bosak, T.* and S. Ono (2011) Large sulfur isotope fractionation does not require disproportionation, *Science*, **333**, 74-77.

*[◊]Sim, M.S., Donovan, K.A., Ono, S., [◊]Templer, S.P. and *T. Bosak* (2011) Effect of electron donors on the fractionation of sulfur isotopes by a marine *Desulfovibrio* sp., *Geochimica et Cosmochimica Acta*, **75**, 4244-4259.

Bosak, T.*, Lahr, D., Pruss, S. B., Macdonald, F. A., [u]Dalton, L. and [◊]Matys, E. (2011) Agglutinated tests in post-Sturtian cap carbonates from Namibia and Mongolia, *Earth and Planetary Science Letters*, **308, 29-40.

Bosak, T. (2011) Microbial contribution to the precipitation of calcium carbonate minerals, *Encyclopedia of Geobiology*, H.W. Fritz, J. Reitner, A. Kappler, V. Thiel, K. Konhauser, P. Reid, X. Zhang (editors), Springer Verlag, Germany.

Pruss, S.B., *Bosak, T.*, Macdonald, F.A., McLane, M., P.F. Hoffman (2010) Microbial facies in a Sturtian cap carbonate, the Rasthof Formation, Otavi Group, northern Namibia, *Precambrian Research*, **181**, 187-198.

*◊Petroff, A.P., ◊Sim, M.S., Maslov, A., Krupenin, M., Rothman, D.H., and *T. Bosak* (2010) Biophysical basis for the geometry of conical stromatolites, *Proceedings of the National Academy of Sciences of the U.S.A.*, **107**, 9956-9961.

Bosak, T.*, Bush, J., Flynn, M., ◊Liang, B., Ono, S., ◊Petroff, A. P., and ◊M.S. Sim (2010) Formation and stability of oxygen-rich bubbles that shape photosynthetic mats, *Geobiology*, **8, 45-55.

Brocks, J.J., *Bosak, T.*, and A. Pearson (2009) Oligoprenyl-curcumanes and other new aromatic isoprenoids from the 1.64 billion years old Barney Creek Formation, *Organic Geochemistry* **40**, 795-801.

Bosak, T.*, ◊Liang, B., ◊Sim, M.S., and ◊A.P.P. Petroff (2009) Morphological record of oxygenic photosynthesis in conical stromatolites, *Proceedings of the National Academy of Sciences of the U.S.A.*, **106, 10939-10943.

Kontnik, R., *Bosak, T.*, Butcher, R.A., Brocks, J.J., Losick, R., Clardy, J., and A. Pearson (2008) Sporulenes, heptaprenyl metabolites from *Bacillus subtilis* spores, *Organic Letters*, **10**, 3551-3554.

Bosak, T., Losick, R. and A. Pearson (2008) A polycyclic terpenoid that alleviates oxidative stress, *Proceedings of the National Academy of Sciences of the U.S.A.*, **105**, 6725-6729.

Maloof, A. C., Kopp, R.E., Grotzinger, J.P., Fike, D.A., *Bosak, T.***,** Vali, H., Poussart, P. M., Weiss, B.P. and J.L. Kirschvink (2007) Sedimentary iron cycling and the origin and preservation of magnetization in platformal carbonate muds, Andros Island, Bahamas, *Earth and Planetary Science Letters*, **259**, 581-598.

Bosak, T., ᵘGreene, S., and D.K. Newman (2007) A likely role for anoxygenic photosynthetic microbes in the formation of ancient stromatolites, *Geobiology*, **5**, 119-126.

Bosak, T. and D.K. Newman (2005) Microbial kinetic controls on calcite morphology in supersaturated solutions, *Journal of Sedimentary Research*, **75**, 190-199.

Bosak, T., Souza-Egipsy, V., and D.K. Newman (2004) An abiotic model for peloid formation, *Geobiology*, **2,** 189-198.

Bosak, T., Souza-Egipsy, V., Corsetti, F.A., and D.K. Newman (2004) Micron-size porosity as a biosignature in carbonate crusts, *Geology*, **32**, 781-784.

Bosak, T. and D.K. Newman (2003) Microbial nucleation of calcium carbonate in the Precambrian, *Geology*, **31**, 577-580.

Bosak, T. and A.P. Ingersoll (2002) Shear instabilities as a probe of Jupiter's atmosphere, *Icarus*, **158**, 401-409.