

## **Roman A. Barco**

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October 12<sup>th</sup>, 2023

### **EDUCATION**

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- Ph. D. University of Southern California  
Biological Sciences, 2014  
Title: The marine, neutrophilic, and chemolithoautotrophic iron-oxidizing bacteria: insights into the physiology of *Zetaproteobacteria* and the discovery of novel iron-oxidizing *Gammaproteobacteria*.  
Committee: Katrina Edwards (advisor; deceased), Kenneth Nealson, David Emerson (Bigelow), Jason Sylvan, and Frank Corsetti.
- B. S. California State University - Los Angeles  
Microbiology, 2004  
Advisor: Tina M. Salmassi

### **APPOINTMENTS**

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- Assistant Research Professor, Dept. of Earth Sciences, University of Southern California, January 2022 – Present.
- Research Scientist, Impossible Metals, January 2022 – October 2022
- Research Scientist, University of Southern California, July 2020 – December 2021.
- Postdoctoral Scholar, University of Southern California (advisor: Jan Amend), August 2017 - June 2020.
- NSF-Postdoctoral Fellow, Bigelow Laboratory for Ocean Sciences (advisor: David Emerson) and University of Southern California (advisor: Kenneth Nealson), August 2015 - July 2017.
- Postdoctoral Scholar, University of Southern California (advisor: Katrina Edwards), September 2014 - July 2015.

### **HONORS**

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- National Science Foundation (NSF) - Postdoctoral Fellowship in Biology, 2015-2017.
- Center for Dark Energy Biosphere Investigations (C-DEBI) - Graduate Student Fellowship, 2011-2013.
- USC Wrigley Institute for Environmental Studies - Graduate Student Summer Fellowship, 2011.

USC Outstanding TA Award, 2008.

USC Marine Environmental Biology Tyler Merit Fellowship, 2007.

## **PUBLICATIONS**

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### *In Preparation:*

**Barco, R.A.**, Abuyen, K., Neely, C., Khalil, C.B., Cervantes, A., Diaz, R., Escobar, A., Ho, K., Hoefler, S., Smith, H.H., Savalia, P., Nealson, K.H., Emerson, D., Tully, B., Amend, J.P. Reclassification of *Hydrogenovibrio halophilus* to *Sorokinibacter halophilus* gen. nov., comb. nov., reclassification of two species of *Hydrogenovibrio* to *Jannaschivibrio* gen. nov., and *Jannaschivibrio edwardsiae* sp. nov., a novel, neutrophilic, iron- and sulfur-oxidizing chemolithoautotroph isolated from iron sulfide.

### *In Review:*

**Barco, R.A.**, Merino, N., Lam, B., Kaplan, M., Budnik, B., Wu, F., Amend, J.P., Nealson, K.H., and Emerson, D. A new working model for electron transport in a versatile, marine, iron-oxidizing chemolithoautotroph. (submitted to *mBio* on December 2022; currently in 2<sup>nd</sup> round of reviews)

### *Accepted:*

Aronson, H.S., Thomas, C., Bhattacharyya, M.K., Eckstein, S.R., Jensen, S.R., **Barco, R.A.**, Macalady, J.L., Amend, J.P. (2023) *Thiovibrio frassasiensis* gen. nov., sp. nov., an autotrophic, elemental sulphur disproportionating bacterium isolated from sulphidic karst sediment, and proposal of *Thiovibrionaceae* fam. nov. *Int. J. Syst. Evol. Microbiol.* 73(8). doi: 10.1099/ijsem.0.006003.

Wu, F., Speth, D.R., Philosofo, A., Crémière, A., Narayanan, A., **Barco, R.A.**, Connon, S.A., Amend, J.P., Antoshechkin, I.A., Orphan, V.J. (2022) Unique mobile elements and scalable gene flow at the prokaryote-eukaryote boundary revealed by circularized Asgard archaea genomes. *Nat. Microbiol.* 7(2):200-212. doi: 10.1038/s41564-021-01039-y

Garber, A.I., Cohen, A.B., Nealson, K.H., Ramírez, G.A., **Barco, R.A.**, Enzingmuller-Bleyl, Gehringer, M.M., and Merino, N. (2021) Metagenomic insights into the microbial iron cycle of subseafloor habitats. *Frontiers in Microbiology.* 12:667944. doi:10.3389/fmicb.2021.667944

Meehan, C.J., **Barco, R.A.**, Loh, Y.E., Cogneau, S., Rigouts, L. (2021) Reconstituting the genus *Mycobacterium*. *Int J Syst Evol Microbiol.* 71(9):004922. doi: 10.1099/ijsem.0.004922.

Murray, A.E., Freudenstein, J., Gribaldo, S., Hatzenpichler, R., Hugenholtz, P., Kampf, P., Konstantinidis, K.T., Lane, C.E., Papke, R.T., Parks, D.H., Rossello-Mora, R., Stott, M.B., Sutcliffe, I.C., Thrash, J.C., Venter, S.N., Whitman, W.B., Acinas, S.G., Amann, R.I., Anantharaman, K., Armengaud, J., Baker, B.J., **Barco, R.A.**, Bode, H.B., Boyd, E.S., Brady, C.L., Carini, P., Chain, P.S.G., Colman, D.R., DeAngelis, K.M., Asuncion de los Rios, M., Estrada-de los Santos, P., Dunlap, C.A., Eisen, J.A., Emerson, D., Ettema, T.J.G., Eveillard, D., Girguis, P.R., Hentschel, U., Hollibaugh, J.T., Hug, L.A., Inskeep, W.P., Ivanova, E.P., Klenk, H.P., Li, W.J., Lloyd, K.G., Löffler, F.E., Makhalanyane, T.P., Moser, D.P., Nunoura, T., Palmer, M., Parro, V., Pedrós-Alió, C., Probst, A.J., Smits, T.H.M., Steen, A.D., Steenkamp, E.T., Spang, A., Stewart,

F.J., Tiedje, J.M., Vandamme, P., Wagner, M., Wang, F.P., Hedlund, B.P., and Reysenbach, A.L. (2020) Roadmap for naming uncultivated Archaea and Bacteria. *Nature Microbiology*. doi: 10.1038/s41564-020-0733-x

**Barco, R.A.**, Garrity, G.M., Scott, J.J., Amend, J., Nealson, K.H., Emerson, D. (2020) A genus definition for Bacteria and Archaea based on a standard genome relatedness index. *mBio*. 11(1): e02475-19. doi: 10.1128/mBio.02475-19

Garber, A.I., Nealson, K.H., Okamoto, A., McAllister S.M., Chan C.S., **Barco, R.A.**, Merino, N. (2020) FeGenie: a comprehensive tool for the identification of iron genes and iron gene neighborhoods in genome and metagenome assemblies. *Frontiers in Microbiology*. 11:37. doi:10.3389/fmicb.2020.00037

Lopez, A., Albino, D., Beraki, S., Broomell, S., Canela, R., Dingmon, T., Estrada, S., Fernandez, M., Savalia, P., Nealson, K., Emerson, D., **Barco, R.A.**, Tully, B.J., Amend, J.P. (2019) Genome sequence of *Mariprofundus* sp. strain EBB-1, a novel marine autotroph isolated from an iron-sulfur mineral. *Microbiology Resource Announcements*. 8(39): e00995-19

**Barco, R.A.**, Garrity, G.M., Scott, J.J., Amend, J., Nealson, K.H., Emerson, D. (2018) A genus definition for *Bacteria* and *Archaea* based on genome relatedness and taxonomic affiliation. *bioRxiv*. 392480. doi:10.1101/392480 (preprint)

McVeigh, D., Skarke, A., Dekas, A.E., Borrelli, C., Hong, W.-L., Marlow, J., Pasulka, A., Jungbluth, S.P., **Barco, R.A.**, Djurhuus, A. (2018) Characterization of benthic biogeochemistry and ecology at three methane seep sites on the Northern U.S. Atlantic margin. *Deep-Sea Research Part II*. 150:41-56.

Neely, C., Bou Khalil, C., Cervantes, A., Diaz, R., Escobar, A., Ho, K., Hoefler, S., Smith, H.H., Abuyen, K., Savalia, P., Nealson, K.H., Emerson, D., Tully, B., **Barco, R.A.**, Amend, J. (2018) Genome sequence of *Hydrogenovibrio* sp. strain SC-1, a chemolithoautotrophic sulfur and iron oxidizer. *Genome Announcements*. 6:e01581-17. doi: 10.1128/genomeA.01581-17.

He, S., **Barco, R.A.**, Emerson, D., and Roden, E.E. (2017) Comparative genomic analysis of neutrophilic iron (II) oxidizer genomes for candidate genes in extracellular electron transfer. *Frontiers in Microbiology*. 8:1584. doi: 10.3389/fmicb.2017.01584

**Barco, R.A.**, Hoffman, C.L., Ramirez, G.A., Toner, B.M., Edwards, K.J., and Sylvan, J.B. (2017). *In-situ* incubation of iron-sulfur mineral reveals a diverse chemolithoautotrophic community and a new biogeochemical role for *Thiomicrospira*. *Environmental Microbiology*. 19(3):1322-1337

Marlow, J., Borrelli, C., Jungbluth, S.P., Hoffman, C., Marlow, J., Girguis, P.R., Dekas, A., Skarke, A., Blackman, D., Fornari, D., Soule, A., Van Dover, C., Bagge, L., **Barco, R.**, Boulahanais, B., Bowman, K., Brugler, M., Bush, S., Djurhuus, A., Fernandez, J., Fulweiler, R., Kinsey, J., Kocot, K., McVeigh, D., Navarro, M., Netburn, A., Pasulka, A., Twing, K., Wagner, A., Zambon, J. (2017) Opinion: Telepresence is a potentially transformative tool for field science. *Proceedings of the National Academy of Sciences*. 114(19):4841-4844.

Ramirez, G.A., Hoffman, C.L., Lee, M.D., Lesniewski, R.A., **Barco, R.A.**, Garber, A., Toner, B.M., Wheat, C.G., Edwards, K.J., Orcutt, B.N. (2016). Assessing marine microbial induced corrosion at Santa Catalina Island, California. *Frontiers in Microbiology*. doi:10.3389/fmicb.2016.01679

**Barco, R.A.**, Emerson, D., Sylvan, J.B., Orcutt, B.N., Jacobson Meyers, M.E., Ramírez, G.A., Zhong, J.D., Edwards, K.J. (2015). New insight into microbial iron oxidation as revealed by the proteomic profile of an obligate iron-oxidizing chemolithoautotroph. *Applied and Environmental Microbiology*. 81(17):5927-37. doi: 10.1128/AEM.01374-15

**Barco, R.A.** and Edwards, K.J. 2014. Interactions of proteins with biogenic iron oxyhydroxides and a new culturing technique to increase biomass yields of neutrophilic, iron-oxidizing bacteria. *Frontiers in Microbiology*. 5:259. doi: 10.3389/fmicb.2014.00259

Bennett, S.A., Toner, B., **Barco, R.A.**, and Edwards, K.J. 2014. Carbon adsorption by Fe oxyhydroxide stalks produced by a lithotrophic iron-oxidizing bacteria. *Geobiology*. doi: 10.1111/gbi.12074.

Orcutt, B.N., **Barco, R.A.**, Joye, S.B., Edwards, K.J. 2012. Summary of carbon, nitrogen, and iron leaching characteristics and fluorescence properties of materials considered for seafloor observatory assembly. *Proc. IODP*. 336: doi:10.2204/iodp.proc.336.108.2012.

Singer, E., Emerson, D., Webb, E.A., **Barco, R.A.**, Kuenen, J.G., Nelson, W.C., Chan, C.S., Comolli, L.R., Ferriera, S., Johnson, J., Heidelberg, J.F., Edwards, K.J. 2011. *Mariprofundus ferrooxydans* PV-1 the first genome of a marine Fe (II) oxidizing *Zetaproteobacterium*. *PLoS ONE*. 6 (9): e25386. doi:10.1371/journal.pone.0025386.

**Barco, R.A.**, Patil, D.G., Xue, W., Ke, L., Khachikian, C.S., Hanrahan, G., Salmassi, T.M. 2006. The development of iodide-based methods for batch and on-line determinations of phosphite in aqueous samples. *Talanta*. 69: 1292-1299.

## FUNDING

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### *Funded*

**Barco, R.A.**, Amend, J.P. Ecosystem recovery following an oil spill – Southern California wetland serves as a fortuitous model system. USC Sea Grant. Notified this year. \$133,000. 2024-2026.

Amend, J.P. Greenhouse gas Bacteria and Archaea Init. Fund. USC. Associated as a research collaborator with other USC faculty (Cameron Thrash and Adam Smith). 3 million. 2023-2028.

Barge, L., Sobron, P., Amend, J.P. et al. In-situ vent analysis diverbot for exobiology research. Associated as a research collaborator. NASA grant: \$98,000. 2020-2023.

Beam, J., **Barco, R.A.**, Emerson, D. Emergent properties of marine and freshwater sediment chemolithoautotrophic microbial communities. Joint Genome Institute Community Science Program. Funding of DNA and RNA sequencing on a variety of samples. August 2017-present.

**Barco, R.A.** Gaining insights into the physiology of neutrophilic, iron-oxidizing chemolithoautotrophs. NSF-BIO Postdoctoral Fellowship: \$138,000; August 2015-July 2017.

**Barco, R.A.**, and Edwards, K.J. Proteomic profiling of neutrophilic, iron-oxidizing *Mariprofundus ferrooxydans*, strain PV-1, grown under different iron sources. Center for Dark Energy Biosphere Investigations (C-DEBI Graduate Student Fellowship); \$64,000; August 2011- August 2013.

**Barco, R.A.** and Edwards, K.J. USC Wrigley Institute Summer Graduate Fellowship; \$4400; June 2011-August 2011.

### **SCIENTIFIC PRESENTATIONS (\* = invited talk)**

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\***Barco, R.A.** Evolutionary strategies for microbial interactions with metals and rocks. Genetics and Evolution Seminar. April 26<sup>th</sup>, 2023 at California State University – Los Angeles.

\***Barco, R.A.** A new working model for electron transport in a versatile, marine, iron-oxidizing chemolithoautotrophy. Geoclub Seminar. May 5<sup>th</sup>, 2022 at California Institute of Technology, Pasadena, CA.

\***Barco, R.A.** The invisible remnants of the Huntington Beach oil spill. November 21<sup>st</sup>, 2021, Surfrider Foundation – USC Chapter, Los Angeles, CA (via Zoom).

\***Barco, R.A.** Lessons learned from studying marine chemolithoautotrophic communities on minerals. C-DEBI Virtual Series Lecture: Techniques for isolating persnickety microbes. August 6th, 2021 (via Zoom).

\***Barco, R.A.** A new working model for electron transport in a versatile, marine, iron-oxidizing chemolithoautotroph. August 20th, 2020, Lawrence Livermore National Laboratory - Bio Seminar (via Zoom).

\***Barco, R.A.** A new working model for electron transport in a versatile, marine, iron-oxidizing chemolithoautotroph. May 14th, 2020, University of Delaware - Clara Chan Laboratory Group (via Zoom).

**Barco, R.A.,** Merino, N., Lam, B., Kaplan, M., Budnik, B., Wu, F., Amend, J.P., Nealson, K.H., and Emerson, D. A new working model for electron transport in a versatile, marine, iron-oxidizing chemolithoautotroph. November 13th, 2019 at the C-DEBI Annual Meeting, Marina, CA (poster).

**Barco, R.A.** Comparative proteomics on a versatile iron-oxidizing chemolithoautotroph. November 14th, 2018 at the C-DEBI Annual Conference, Marina, CA.

**Barco, R.A.** Comparative proteomics on a versatile iron-oxidizing chemolithoautotroph. Department of Earth Sciences Seminar. October 22nd, 2018 at the University of Southern California, Los Angeles, CA.

**Barco, R.A.** A genus demarcation approach based on taxonomic affiliation. November 15th, 2017 at the C-DEBI Annual Conference, Marina, CA.

\***Barco, R.A.,** Nealson, K.H., Emerson, D. Early temporal microbial succession of marine chemolithoautotrophic communities on iron sulfides. August 18th, 2017 at Goldschmidt Conference, Paris, France.

**Barco, R.A.** A new biogeochemical role for *Thiomicrospira*. Bigelow Science Symposium. September 9th, 2016 at Bigelow Laboratory for Ocean Sciences, East Boothbay, ME.

**Barco, R.A.** The marine, neutrophilic, and chemolithoautotrophic iron-oxidizing bacteria: insights into the physiology of *Zetaproteobacteria* and the discovery of novel iron-oxidizing

*Gammaproteobacteria*. Defense presentation. April 21st, 2014 at University of Southern California, Los Angeles, CA.

**Barco, R.A.** Near-shore *in-situ* study of marine, neutrophilic, iron-oxidizing bacteria. Marine Environmental Biology Seminar. February 14th, 2012 at University of Southern California, Los Angeles, CA.

**\*Barco, R.A.** In search of biomarkers for iron-oxidizing bacteria (FeOB). NSF STC Site Review (hosted by Center for Dark Energy Biosphere Investigations). January 30th, 2012 at University of Southern California, Los Angeles, CA.

**Barco, R.A.** Near-shore *in-situ* study of marine, neutrophilic, iron-oxidizing bacteria. Wrigley Summer Fellows Symposium. September 23rd, 2011 at University of Southern California, Los Angeles, CA.

**Barco, R.A.** In search of biomarkers for iron-oxidizing bacteria (FeOB). In search of biomarkers for iron-oxidizing bacteria (FeOB). Marine Environmental Biology Seminar. May 5th, 2011 at University of Southern California, Los Angeles, CA.

**Barco, R.A.** Extraction of proteins from a filamentous, neutrophilic, iron-oxidizing bacteria, *Mariprofundus ferrooxydans*. Marine Environmental Biology Seminar. March 30th, 2010 at University of Southern California, Los Angeles, CA.

**Barco, R.A.** In search of iron-oxidizing proteins in *Mariprofundus ferrooxydans*, strain PV-1. Marine Environmental Biology Seminar. March 24th, 2009 at University of Southern California, Los Angeles, CA.

## **SYNERGYSTIC ACTIVITIES**

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### ***Community Service***

Reviewer for:

*ACS Earth and Space Chemistry*  
AGU Books  
*Applied and Environmental Microbiology*  
*Applied Microbiology and Biotechnology*  
*BMC Genomics*  
*Environmental Microbiology*  
*Environmental Microbiology Reports*  
*Environmental Science and Technology*  
*Frontiers in Microbiology*  
*Geomicrobiology Journal*  
*Journal of Agricultural and Food Chemistry*  
*Microbiology Spectrum*  
*mSystems*  
NASA  
National Science Foundation  
*Nature Microbiology*  
*PeerJ*

## **Outreach**

Letters to a Pre-scientist: This is a pen pal program that connects 5th-10th grade students in US low-income communities with scientists in order to humanize STEM professionals, demystify STEM career pathways, and inspire students to think about science. 2020-2021.

Community College Cultivation Cohort: Supervised and mentored 18 community college students at USC during three different years. In 2017 and 2018, the students characterized iron-oxidizing microbes that I had isolated from the Gulf of Maine and Big Fisherman's Cove in Catalina Island, CA. In 2016, students characterized an iron-reducing microbe isolated from Loihi Seamount, Hawaii.

Live interview via satellite while aboard the R/V *Atlantis* (AT36 EAGER cruise) with elementary school students at the American Museum of Natural History in New York City. This was a 15-minute interview about my recent dive in the submersible Alvin exploring methane seeps and about environmental microbiology in general. This was a collaboration with the Inner Space Center at the University of Rhode Island. July 2016.

Participated in a children's book titled "Where Wild Microbes Grow: The search for life under the seafloor" by Kevin Kurtz and Alice Feagan. The eBook for K-12 students is free and available on iTunes as well as online at <http://joidesresolution.org/node/2998>. The book was sponsored by C-DEBI, a NSF-funded Science and Technology Center. Fall 2015.

Mentored John Zhong (undergraduate student at USC). John assisted me with culturing iron-oxidizing bacteria, performing cell counts and with the production of media. John was awarded a USC Discovery Scholar Medal for work related to one of my supervised projects involving proteomics and recently-discovered *Zetaproteobacteria*. May 2010-May 2013.

Co-mentored three high school students from Animo Leadership Charter High School: Anthony Hernandez, Anthony Esparza and Kevin Sanchez as part of the Rising Deep Scholars Program (C-DEBI sponsored). Assisted the students in analyzing clone libraries and in producing a phylogenetic tree for a poster. Spring 2013.

Helped construct teaching material in Spanish and English for dissemination in the internet and in international conferences in a joint effort by C-DEBI and Animo Leadership Charter High School. November 2012.

USC Young Researcher Program. Mentored Miguel Molina, a high school student from Film and Theater Charter High School who is part of a minority that is under-represented in the Sciences. Miguel was involved in a project related to the effects of arsenic exposure in iron-oxidizing bacteria. Summer 2011.

## **FIELD EXPERIENCE**

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- Huntington Beach Wetlands, oil spill (2020-present).
- Northeastern U.S. continental margin (methane seeps off the coast of MA), R/V *Atlantis* cruise AT36 with HOV *Alvin*, July-August 2016.
- Loihi Seamount, R/V *Kilo Moana* with ROV *Jason II*, August 2007.
- Hot springs of Hot Creek, CA, 2003-2006.
- Mammoth Mountain (tree-kill area), CA, 2003-2006