

E. Marie Muehe, PhD

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Research Experience

Postdoctoral Fellow – Stanford School of Earth, Energy and Environmental Sciences

2015 – Current

Department of Earth System Science – Soil and Environmental Biogeochemistry Lab
Funded by the German Research Foundation and Marie S. Curie by the EU's H2020 Program
Impact of Climate Change on the Uptake and Accumulation of Arsenic in Rice

Postdoctoral Scholar – University of Tuebingen, Germany

2015

Department of Applied Geosciences
Biologically-Mediated Recovery of Precious Metals from Household Incineration Waste

Education

Ph.D. in Environmental Sciences – *summa cum laude*

2014

University of Tuebingen – Applied Geosciences / Ruhr University Bochum – Plant Physiology, Germany
Funded by the German Federal Environmental Foundation (DBU)
Plant-Microbe-Soil Interactions in Metal(loid)-Contaminated Environments

Environmental Volunteering Service

2009

Zeekovlei and Rondevlei Environmental Education Center, Cape Town, South Africa
Funded by the German Federal Ministry for Economic Cooperation and Development
Environmental Protection and Education in the Western Cape, South Africa

Diploma in Biology – grade 1.1

2008

University of Tuebingen, Germany
*Response of Rice Plant (*Oryza sativa* L.) to Arsenic-Contaminated Water and Fe(II)-Oxidizing Bacteria*

Oregon State University, USA

2004-2005

Study Abroad Program
Funded by the State of Baden-Wuerttemberg, Germany

Highlights

Awarded Funding: \$581,850

Publications: 12 published, 3 pending, (339 total citations, H-Index: 9)

Book Chapters: 1 published

Students Supervised: 3 Master Students, 3 Bachelor Students, 5 Scientific Practice Students

Conference Contributions (Presenting author only): 3 invited oral, 16 oral, 5 poster

Honors and Awards:

- Participation at the **STAMPS MBL course** in Woods Hole, 2017
- Participation as Young Scientist at the **Lindau Nobel Laureate Meeting**, 2015
- **Marie-Sklodowska-Curie Individual Global Postdoc Fellowship**, EU-H2020, 2015
- **German Research Foundation Postdoc fellowship**, 2014
- Medalist of the **German Dissertation Award** (Science) (Koerber-Foundation), 2014
- **Outstanding Dissertation Award**, University of Tuebingen, 2014
- **Outstanding Dissertation Award**, Department of Geosciences, University of Tuebingen, 2014
- Medalist for student presentations at SEGH Conference, Toulouse, France, 2013
- **German Federal Environmental Foundation PhD fellowship**, 2009
- Medalist for the **BIOTECHNICA study award for master theses**, 2008
- Outstanding Poster award for master theses, University of Tuebingen, 2007

Public Recognition of Work:

- German-wide TV documentary: "Arsen – der schleichende Tod", 2016, synchronized into English, 2017
- BUNDjugend report on phytoremediation of cadmium-contaminated soils, 2016
- Report in a German magazine (Chrismon) on PhD thesis, 2014
- TV report in the German Southwest Radio (SWR) on PhD thesis, 2014
- German-wide press release on the microbial remediation of cadmium-contaminated soils, 2013
- Report by BIOPRO Baden-Wuerttemberg GmbH on bioremediation of cadmium-contaminated soils, 2013

Honors and Awards

1. Participant in the *Strategies and Techniques for Analyzing Microbial Population Structure* MBL 2017 course
2. Medalist of the German Dissertation Award (Science) (Koerber-Foundation), 2014, awarded with \$5,250
3. Outstanding Dissertation Award, University of Tuebingen, 2014
4. Outstanding Dissertation Award, Department of Geosciences, University of Tuebingen, 2014
5. Medalist for student presentations at SEGH Conference, Toulouse, France, 2013
6. German Federal Environmental Foundation PhD fellowship, 2009
7. Medalist for the BIOTECHNICA study award for master theses, 2008, awarded with \$1,600
8. Outstanding Poster award for master theses, University of Tuebingen, 2007

Current and Previous Funding (Total Awarded: \$581,850)

1. Participation in the *Strategies and Techniques for Analyzing Microbial Population Structure* MBL 2017 course, funded by MBL 2017, **PI - \$900**
2. RACe-661674, EU Marie-Sklodowska-Curie Individual Global Fellowship, postdoctoral training award, **PI – \$251,000** (€239,861), *The impact of climate change on the uptake of arsenic into rice*
3. 4521, SSRL Stanford Synchrotron Radiation Lightsource – user proposal, **Lead-PI**, *Identifying changes in toxic element uptake by and speciation in rice upon changing climatic conditions*
4. Participation as Young Scientist at the Lindau Nobel Laureate Meeting, funded by the Koerber Foundation, **PI – \$3,000**
5. MU 3842/2-1, DFG German Research Foundation Postdoctoral fellowship, **PI – \$88,000** (€82,000), *The impact of global warming on the uptake of arsenic into rice plants*
6. Bio2value – KF2041705RH4, ZIM The Central Innovation Programme for SMEs of the German Federal Ministry for Economic Affairs and Energy, **Co-PI – \$179,000** (€171,262), *Recovery of economically valuable metals from incineration slag using enriched microbial consortia from different environments*
7. Equal opportunity commission travel grant of the University of Tuebingen, **PI – \$1,300** (€1,242)
8. DAAD German Academic Exchange Service conference travel grant, **PI – \$3,000**
9. Goldschmidt student travel grant for Goldschmidt Conference 2011, **PI – \$1,000**
10. Goldschmidt student travel grant for Goldschmidt Conference 2010, **PI – \$3,000**
11. 20009/052, DBU German Federal Environmental Foundation PhD fellowship, **PI – \$42,200** (€40,400), *Impact of mineral-forming and dissolving bacteria on the uptake and accumulation of cadmium in *Arabidopsis halleri**
12. German Federal Ministry for Economic Cooperation and Development Weltwaerts-Fellowship for volunteering service in South Africa, **PI – \$6,300**
13. Baden-Wuerttemberg study abroad fellowship, **PI – \$3,150** (€3,000)

High School Funding

1. Felixstowe International College, UK: Full one-year scholarship for graduating with GCSE (10th grade)
2. Tettenhall College, UK: 50% two-year science scholarship for graduating with A-levels (11th-12th grade)

Peer-Reviewed Journal Publications

1. **E. M. Muehe**, G. Morin, L. Scheer, P Le Pape, I. Esteve, B. Daus, A. Kappler; *Environmental Science and Technology* **2016**; 50(5), 2281-2291; *Arsenic(V) incorporation in vivianite during microbial reduction of arsenic(V)-bearing biogenic Fe(III) (oxyhydr)oxides*.
2. **E. M. Muehe**, C. Schmidt, J. He, T. Helle, A. Kappler; *Advanced Materials Research*, **2015**, 1130, 652-655; *Microbially supported recovery of precious metals and rare earth elements from urban household waste incineration slag*.
3. **E. M. Muehe**, P. Weigold, I. J. Adaktylou, B. Planer-Friedrich, U. Krämer, A. Kappler, S. Behrens; *Applied and Environmental Microbiology* **2015**; 81(6), 2173-2181; *Rhizosphere microbial community composition affects cadmium and zinc uptake of the metal-hyperaccumulating plant *Arabidopsis halleri**.
4. **E. M. Muehe**, A. Kappler, C. Chaban, B. Daus, *Bio-protocol* **2015**; 5(8), e1445. <http://www.bio-protocol.org/e1445>; *Measuring the arsenic content and speciation in different rice tissues*.
5. **E. M. Muehe** and A. Kappler; invited review for the research front on arsenic for *Environmental Chemistry* **2014**; 11, 483–495; *Arsenic mobility and toxicity in South and Southeast Asia – a review on biogeochemistry, health and socio-economic effects, remediation and risk predictions*.

6. **E. M. Muehe**, J. Eisele, B. Daus, A. Kappler, K. Harter, C. Chaban; *Plant Molecular Biology* **2014**; 85(3), 301-316; *Are rice (*Oryza sativa* L.) phosphate transporters regulated similarly by phosphate and arsenate? – a comprehensive study.*
7. **E. M. Muehe**, M. Obst, A. Hitchcock, T. Tyłszczak, S. Behrens, C. Schroeder, J. M. Byrne, M. Michel, U. Kraemer, A. Kappler; *Environmental Science and Technology* **2013**; 47, 14099-14109; *Fate of Cd during microbial Fe(III) mineral reduction by a novel and Cd-tolerant *Geobacter* species.*
8. **E. M. Muehe**, I. J. Adaktylou, M. Obst, F. Zeitvogel, S. Behrens, B. Planer-Friedrich, U. Kraemer, A. Kappler; *Environmental Science and Technology* **2013**; 47, 13430–13439; *Organic carbon and reducing conditions lead to cadmium immobilization by secondary Fe mineral formation in a pH-neutral soil.*
9. **E. M. Muehe**, L. Scheer, B. Daus, A. Kappler; *Environmental Science and Technology* **2013**; 47, 8297–8307; *Fate of arsenic during microbial reduction of biogenic vs. abiogenic As-Fe(III)-mineral co-precipitates.*
10. S. Kleinert, **E. M. Muehe**, N. Posth, U. Dippon, B. Daus, A. Kappler; *Environmental Science and Technology* **2011**; 45(17), 7533–7541; *Biogenic Fe(III) minerals lower the efficiency of iron mineral-based commercial filter systems for arsenic removal.*
11. **E. M. Muehe**, S. Gerhardt, B. Schink, A. Kappler; *FEMS Microbiology Ecology* **2009**; 70(3), 335–343; *Ecophysiology and the energetic benefit of mixotrophic Fe(II) oxidation by various strains of nitrate-reducing bacteria.*

Book Chapters

1. Kappler, D. Emerson, J. A. Gralnick, E. E. Roden, **E. M. Muehe**; invited revisions for the Iron Geomicrobiology Chapter in Ehrlich's Geomicrobiology **2015**, 6th edition, editors: D. K. Newman, A. Kappler and H. L. Ehrlich

Popular Science Publications (Not peer-reviewed)

1. **E. M. Muehe**, A. Kappler; invited by BIOSpektrum **2016**; 20(3), 316-318; *Biogene Eisenminerale kontrollieren das Umweltverhalten toxischer Metalle. (Biogenic Iron minerals control the environmental fate of toxic metals).*

Manuscripts in review and in preparation

1. S. Abramova, J. He, D. Wimmer, M.-L. Lemloh, **E. M. Muehe**, B. Gann, E. Roehm, R. Kirchhof, M. G. Babechuk, R. Schoenberg, H. Thorwarth, T. Helle, A. Kappler, **submitted** to Journal of Hazardous Materials; *Leaching behavior and valuable contents of processed municipal solid waste incineration residues from Southwestern German.*
2. R. Yan, A. Kappler, **E. M. Muehe**, K.-H. Knorr, M. A. Horn, A. Poser, R. Lohmayer, S. Peiffer, **submitted** to Geomicrobiology Journal; *The effect of reduced sulfur speciation on the chemoautotrophic pyrite oxidation with nitrate.*
3. J. E. Forsyth, M. S. Islam, S. M. Parvez, R. Raqib, M. S. Rahman, **E. M. Muehe**, S. Fendorf, S. P. Luby; **submitted**; *Prevalence of elevated blood lead levels among pregnant women and sources of lead exposure in rural Bangladesh.*
4. **E. M. Muehe**, J. He, D. Wimmer, A. Sundman, B. Planer-Friedrich, K. Konhauser, A. Kappler; in preparation; *Acidic extraction of economically important metals from bottom ash of a waste incineration plant.*
5. **E. M. Muehe**, J. Lezama-Pacheco, S. Fendorf, in preparation; *Increased arsenic mobility in paddy soil due to climate change.*
6. **E. M. Muehe**, T. Wang, B. Planer-Friedrich, S. Fendorf, in preparation; *Climate change and future elevated soil arsenic decrease rice grain yield and quality substantially.*
7. **E. M. Muehe**, J. Harter, B. Planer-Friedrich, U. Kraemer, A. Kappler, S. Behrens, in preparation; *Rhizosphere microbial communities correlating with the accumulation of cadmium by the phytoremediating plant *Arabidopsis halleri*.*
8. **E. M. Muehe**, J. M. Byrne, A. Sundmann, J. Lezama-Pacheco, S. Fendorf, A. Kappler; in preparation; *Potential for cadmium to be incorporated into the structure of magnetite during its bioformation.*

Select Conference Contributions

1. **2017** Goldschmidt Conference, Paris, France; Oral: Climate change coupled with elevated soil arsenic will decrease rice productivity and grain quality.
2. **2016** Science and Technology for Sustainable Cocoa Development Conference, Lima and Tarapoto, Peru; **Oral**: How soil microbial communities relieve plants of metal stress.
3. **2016** Iron Biogeochemistry Conference, Telluride, Co, USA; **Oral**: How iron cycling in the rhizosphere affects metal uptake by plants.
4. **2016** Goldschmidt Conference, Yokohama, Japan; **Oral**: Impact of climate change on the dynamics of arsenic in paddy soils.
5. **2015** Goldschmidt Conference, Prague, Czech Republic; **Oral (invited)**: Rhizosphere microorganisms enhance Cd accumulation by the plant *Arabidopsis halleri*.
6. **2015** Goldschmidt Conference, Prague, Czech Republic; **Oral**: Microbially stimulated recovery of precious metals from household waste incineration slag.

7. **2014** AGU-Fall Meeting, San Francisco, USA; **Oral (invited)**: Iron cycling at low pH – potential application for the recovery of precious metals from industrial waste.
8. **2013** Goldschmidt Conference, Florence, Italy; **Oral (invited)**: Cd mobility in anoxic Fe-mineral-rich environments – potential use of Fe(III)-reducing bacteria for soil remediation.
9. **2013** SEGH Conference, Toulouse, France; **Oral**: Fate of arsenic during microbial reduction of arsenic-bearing biogenic and abiogenic Fe(III) oxyhydroxides.
10. **2012** Goldschmidt Conference, Montreal, Canada; **Oral**: Fate of As during microbial reduction of As(V)-bearing biogenic Fe(III)-oxyhydroxide.
11. **2011** Arsenic Conference, Hanoi, Vietnam; **Oral**: Mobilization of sorbed and co-precipitated As from biogenic Fe(III) (hydr)oxides by the Fe(III)-reducer *Shewanella oneidensis* MR-1.
12. **2011** Goldschmidt Conference, Prague, Czech Republic; **Oral**: Fate of As upon microbial Fe(III) reduction of As-bearing biogenic Fe(III) minerals.
13. **2010** GMS Conference, Leipzig, Germany; **Oral**: Effect of Fe mineral-transforming bacteria on the uptake and accumulation of Cd by the metal-hyperaccumulating plant *Arabidopsis halleri*.
14. **2010** Goldschmidt Conference, Knoxville, Tennessee, USA; **Oral**: Mobilization of sorbed and co-precipitated arsenic from biogenic Fe(III) (hydr)oxides by the Fe(III)-reducer *Shewanella oneidensis* MR-1.
15. **2010** Arsenic Conference, Tainan, Taiwan; **Oral**: Impact of iron bacteria on arsenic (im)mobilization in commercial granulated iron mineral filters.
16. **2008** Goldschmidt Conference, Vancouver, Canada; **Oral**: Immobilisation of arsenic in paddy soil by iron(II)-oxidizing bacteria.

Organization of Scientific Meetings

1. **2017** Goldschmidt Conference, France; **Session co-chairing**: Biogeochemical Processes Under Dynamic Redox Conditions in Soils and Sediments – Controls and Feedbacks
2. **2016** Goldschmidt Conference, Japan; **Session co-chairing**: Root meets soil: A hotspot for bio-geochemical processes.
3. **2015** Goldschmidt Conference, Czech Republic; **Session co-chairing**: Iron biogeochemistry in the environment: From nanoscale processes to macroscopic observations.
4. **2015** European Geochemistry Union EGU general assembly, Austria; **Session co-chairing**: Rhizosphere processes, soil management roles, and efficacy control in phytoremediation and phytomining research.
5. **2013** Goldschmidt Conference, Italy; **Session co-chairing**: Biogeochemical cycles in the rhizosphere: examining carbon, trace and heavy metal cycling at the plant-soil interface.

Teaching Experience

Currently participating in the Stanford Postdoc Teaching Certificate (<http://postdocs.stanford.edu/education/teachingcertificate.html>).

Classes taught:

Module *Soil Biology* in Scott Fendorf's class *Science of Soils* (EARTHSYS 155, ESS 155) at Stanford U.

Module *Plant-Microbe-Soil Interactions* in Scott Fendorf's class *Science of Soils* (EARTHSYS 155, ESS 155) at Stanford U

Supervised Students:

3 Master Students (Lukas Scheer, Irini Adaktylou, Dominik Wimmer)

3 Bachelor Students (Irini Adaktylou, Benjamin Magri, Anneli Kommana)

4 Scientific Practice Students (Carla Herth, Daniel Männle, Dominik Wimmer, Alexander Betz)

1 Guest researcher (Ruiwen Yan)

2 Summer interns at Stanford (Tianmei Wang, Mariejo Plaganas)

Teaching Assistant:

Geomicrobiological field excursion to the Engadin, Switzerland, followed by a lab course 2013

Geomicrobiological field excursion to the Engadin, Switzerland, 2008

German conversation at Oregon State University, Corvallis, OR, 2004-2005

Environmental Education:

~50 environmental guided tours through Rondevlei Preserve, South Africa

~15 3-day environmental education school camps, Zeekovlei, South Africa

Ultimate Frisbee Coach:

University of Tuebingen – beginner classes, 2009-2011

University of Tuebingen – advanced classes, 2009-2012

SV03 Club Tuebingen, division Ultimate Frisbee – competitive classes, 2010-2013

Additional Scientific Service Activities

Co-editor for the special issue Rhizosphere Processes in the Journal Soil Processes

Associate editor for Bio-protocol

Mentor for young scientists at Goldschmidt Conference 2015

Evaluation of student posters at AGU 2014

Presentation at the Young Scientist Seminar, Tuebingen, Germany: *Funding opportunities for Postdocs*

Manuscript Peer Review

Plant and Soil

mBio

Environmental Science and Technology Letters

Geochimica et Cosmochimica Acta

Environmental Science: Processes and Impacts

Environmental Chemistry

Environmental Science and Technology

Pedosphere

Environmental Pollution

Bio-protocol

Water Research

Professional Memberships

American Geophysical Union

European Association of Geochemistry

Soil Science Society of America

Skills

Sampling of soil, plants and microbial samples in the field and in experiments

Set-up, building, plumbing, wiring and running of climate incubation chambers for plants and soil

Microbial cultivation (aerobic, anaerobic)

Microbial isolation from environmental samples

DNA extractions

Gel electrophoreses

PCR

qPCR

Cloning

ICP-mass spectrometry

ICP-optical emission spectrometry

Total carbon analyzer

Elemental analyzer

Discrete analyzer

Ion chromatography

Microwave digestion of soil and plant material

Freeze drying

Gas chromatography

XRF

XRD

O₂ microelectrodes

O₂, pH, CO₂ optodes

Synchrotron imaging (SAM's software)

Geochemist's Workbench

Languages

German (native), English (fluent), French (basic), Spanish (basic)