

Department of Geology
University of Vermont
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EDUCATION

- 01/2008** PhD in Physics, Chemistry and Biology of the Environment, Université Louis Pasteur, Strasbourg, France. *Advisor: Prof. Laurence Warr (CNRS-France, University of Greifswald, Germany).* Title of thesis: *Hydration of swelling clays and bacteria interaction - An experimental in situ reaction study.*
- 07/2004** MS (Diploma) in Mineralogy, Geology and Geochemistry, Ruprecht Karls University of Heidelberg, Germany. *Advisor: Laurence Warr.* Title of thesis: *Low temperature mineral alteration in fault zones of the Lizard Ophiolite Complex, SW-England.*

APPOINTMENTS

- 08/2013- current** Assistant Professor of Geochemistry, University of Vermont
- 10/2012-07/2013** Assistant Research Scientist, Critical Zone Observatory (CZO), University of Arizona
- 1/2010-09/2012** Postdoctoral Research Associate, NSF Critical Zone Observatory (CZO), University of Arizona
- 9/2008-12/2009** Visiting Postdoctoral Scholar, Department of Soil, Water and Environmental Sciences (SWES), University of Arizona, Tucson
- 12/2007-2/2008** Graduate Research Assistant, Institute of Geography and Geology, Ernst Moritz Arndt University, Germany

RESEARCH INTERESTS

Laboratory and field based investigations of low temperature (bio)-geochemical processes, including: carbon dynamics, dissolved organic matter (DOM) chemistry, catchment hydrology and biochemistry, biotic and abiotic primary and secondary mineral alteration and weathering, clay mineralogy, general environmental geochemistry.

RESEARCH EXPERIENCE

(PostDoc) experimental and field research on subsurface and stream water biogeochemistry:

- a) **Carbon cycling in the critical zone and the impacts of global climate change:** Characterizing dissolved organic and inorganic carbon in soils and streams with a combination of analytical tools (including DOC, DIC, carbon isotopes, UVvis-, fluorescence- and FTIR-spectroscopy) and computational quantification (PARAFAC analysis of fluorescence data).
- b) **How is stream water carbon affected by Global Climate Change? Research questions and findings:** How are short term stream water carbon dynamics impacted by changes in snowpack (decreased thickness, duration) as predicted for future winter climate in SW-USA? C fluxes after the dry winter (2011) were 90% lower than after the snow-rich winter (2010). Summer P_{CO2} exceeded atmospheric values in both years (up to 12 times). Aspect matters: the N-facing stream exported more DOC (snowmelt) and less CO₂ (summer, Perdrial et al. *under review*).
- c) **Will seasonally snow covered catchments continue to be a net sink for carbon in a changing climate? Research questions and findings:** Will the CZ preserve its sink character during dryer and warmer years and when logging effect wears off? Although all studied mountain catchments remain

sinks for carbon, increased stand density suggest that past logging (~40 years ago) boosts sink character that may shift to source character when logging effect wears off (Perdrial et al. in prep. a).

- d) **What are the effects of wildfires on stream water carbon?** Research questions and findings: Can we separate the fire signal from the ‘noise’ produced by other factors that impact stream water carbon? PARAFAC analyses of fluorescence spectra showed a decrease of reduced quinone-like coupled to an increase of oxidized quinone-like fluorescence in the burned upper cm. This signature is translated into the streams and can be used as an indicator for ash contribution to the streams (Perdrial et al. 2012 GSA talk abstract).
- e) **What’s the influence of water availability on carbon cycling and the development of the critical zone?** This SAHRA (Sustainability of semi-arid hydrology and riparian areas, NSF) funded project is in its starting phase and takes advantage of the close collaboration with colleagues from the University of Texas El Paso (UTEP) and the Josephs Stefan Institute in Slovenia and isotope analytical capacities to study CZ carbon cycling.

2) I study what controls weathering fluxes and chemical denudation by characterizing solute sources from headwater catchment soils and streams.

- a) **What are ideal sampling approaches that work under unsaturated conditions** and that are able to sample for a wide array of solutes (carbon and lithogenic (trace) elements)? Main findings: Passive capillary wick samplers (PCaps) are well adapted to sample dissolved organic matter (Perdrial et al. in press), and most anions and metals. However wick constituents (Si, Na, Ca, Mg) are released and need to be corrected for (Perdrial et al. submitted).
 - b) **Do carbon and water fluxes control chemical denudation?** Research questions and findings: How can we effectively link cross disciplinary observations of water and energy fluxes with landscape evolution? How does Global Climate Change impact weathering and chemical denudation? Quantification of climatic drivers is possible by their integration into a single currency (EEMT, Rasmussen et al. 2005) that accounts for energy associated with water and carbon fluxes. Prediction of catchment solute loss associated with *incongruent landscape dissolution* (i.e. chemical denudation) is correlated with annual CZ inputs of energy associated with carbon and water (e.g. effective precipitation and net ecosystem exchange, Perdrial et al. 2012 Goldschmidt talk abstract, Perdrial et al. in prep.).
- 1) Outside of the framework of the CZO project I’m part of the NSF funded project on **‘Plant-microbe-mineral interaction as a driver for rock weathering and chemical denudation’**, a large scale experimental study that looks at the role of bacterial-mycorrhizal fungi associations in primary mineral alteration. Rocks that are used in this study were sampled from CZO sites and allow comparison between the experimental mesocosm scale, a large scale Landscape Evolution Observatory (LEO, B2), and the CZO catchment scale. This experiment completed the set-up phase recently and will generate data shortly.

(PhD) experimental study on in-situ biogeochemical secondary mineral alteration

- 1) **Development of analytical techniques for in-situ XRD monitoring of smectite hydration** during the infiltration of solutions under confined volume conditions with minimal disturbance of the sample system (Warr & Berger (=Perdrial), 2007)
- 2) **Multidisciplinary approach of abiotic and biotic secondary mineral (clay) alteration:** smectite-*Shewanella putrefaciens* interaction studied by combining classical microbiological methods (e.g. viable cell counts) and analytical mineralogy and geochemistry (XRD, ESEM, SEM, TEM, ICP-AES) (Perdrial et al. 2009, Perdrial & Warr, 2011).

(MS) field study on abiotic alteration of primary ultramafic rocks and the formation of secondary minerals

- 1) Geological field mapping of ultramafic rocks of the Lizard Ophiolite in SW-England.
- 2) Characterization of secondary minerals by XRD and SEM and development of a regional concept hydrothermal mineral alteration in fault zones

RESEARCH TOOLS

Carbon Analyzer, FTIR spectroscopy, ICP-MS, IC, SEM, UVvis and fluorescence spectroscopy, XRD

GRANTS

Research Grant - SAHRA (2012, co-author – PI's: J. McIntosh, C. Rasmussen) – 10k\$

Research Grant - 3 years, NSF-GLTG (2010-2013,co-author – PI's: K. Dontsova, J. Chorover, T. Huxman, R. Maier) – 424k\$

Research Grant - 3 years French Ministry of Research Fellowship (2004-2007) - ~75k\$ accepted

Research Grant - 1 year DAAD Research Fellowship (2004-2005) - ~20k\$ not accepted

CMS-Student Travel Grant - 2006 & 2007 (- 1000 \$)

Goldschmidt Student Travel Grant 2008 (- 500\$)

PUBLICATIONS (Note that J.N.Berger = J.N.Perdrial)

PhD Thesis:

J.N. Berger (2008). Hydration of swelling clays and bacteria interaction- An experimental *in situ* reaction study. Department of Earth and Planetary Science, University of Louis Pasteur, 204 p.

JOURNAL ARTICLES (PUBLISHED AND SUBMITTED)

J.N.Perdrial, N. Perdrial, A. Vasquez-Ortega, C. Porter, J. Chorover. Experimental assessment of fiberglass passive capillary wick sampler (PCap) suitability for inorganic soil solution constituents. Submitted to SSSAJ.

A. Vázquez-Ortega, **J.N. Perdrial**, A. Harpold, MK. Amistadi, C. Rasmussen, J. C. McIntosh, J. Chorover. Probing the Use of Rare Earth Elements and Yttrium as Organomarkers in the Jemez River Basin Critical Zone Observatory: Linking Geochemical Processes from the pedon scale to the watershed scale.Submitted to GCA.

J.N. Perdrial, J. McIntosh, A. Harpold, P. Brooks, P. Troch, J. Ray, X. Zapata-Rios, C Porter, J.Chorover. : Controls of stream water carbon in seasonally snow-covered mountain catchments: impact of water fluxes, catchment aspect and seasonal processes. Under review, Biogeochemistry.

J.N. Perdrial., N.Perdrial, A. Harpold, X. Gao, R. Gabor, K. LaSharr, J. Chorover 2012. Impacts of sampling dissolved organic matter with capillary wicks versus aqueous soil extraction. Soil Science Society of America Journal. <https://www.soils.org/publications/sssaj/view/first-look/s12-0061.pdf>

Adrian Harpold, Xavier Zapata Rios, **J.N.Perdrial**, Jennifer McIntosh, Paul Brooks, Tom Meixner, Jon Chorover. Quantifying Variation in Solute Sources and Nutrient Cycling in Montane Headwater Catchments. Under review, JGR.

Chorover J., Troch P.A., Rasmussen C., Brooks P., Pelletier J., Breshears D.D., Huxman T., Lohse K., McIntosh J., Meixner T., Papuga S., Schaap M., Litvak M., **Perdrial J.N.**, Harpold A., and Durcik M. (2011) How Water, Carbon, and Energy Drive Critical Zone Evolution: The Jemez-Santa Catalina Critical Zone Observatory. Vadose Zone Journal 10(3): 884-899

J.N. Perdrial and L.N. Warr (2011). Hydration behavior of MX80 bentonite in a confined volume system: Implications for backfill design. *Clays and Clay Minerals* 59(6): 640-653.

N. Perdrial, **J.N. Perdrial**, J.E. Delphin, F. Elsass, N. Liewig (2010). Temporal and spatial monitoring of mobile nanoparticles in a vineyard soil: evidence of nanoaggregate formation. *European Journal of Soil Science*, **61**, 456-468.

L.N. Warr, **J.N. Berger**, M-C. Lett and M. Kodja (2009). Clay-enhanced bioremediation of marine oil pollution *Applied Clay Science*, 46, 337-345.

J.N. Perdrial, L.N. Warr, M-C. Lett F. Elsass and N. Perdrial (2009). Interaction between smectite and bacteria: implications for bentonite backfill in nuclear waste disposal. *Chemical Geology*, 264, 281-294.

L.N. Warr, **J.N. Berger** (2007). Hydration of bentonite in natural waters: Application of “confined volume” wet-cell X-ray diffractometry. *Physics and Chemistry of the Earth* 32, 247–258.

JOURNAL ARTICLES (IN PREPARATION)

Courtney Porter, J. McIntosh, L. Derry, T. Meixner, J. Chorover, P. D. Brooks, C. Rasmussen, **J.N. Perdrial**, D. Vinson. Determining solute inputs to soil and stream waters in a seasonally snow-covered mountain catchment in northern New Mexico using Ge/Si, ⁸⁷Sr/⁸⁶Sr and ion chemistry. Submission planned 01/2013 to GCA.

Michael Pohlmann, **Julia N Perdrial**, Jessica Prescott-Smith, Mary-Kay Amistadi, Jon Chorover. Impact of storm events on stream water DOC- metal associations: resolving co-variation by colloid size fractionation. Submission planned 11/2013 to Hydrological Processes.

J.N. Perdrial, Craig Rasmussen, Jennifer McIntosh, Paul Brooks, Adrian Harpold, Xavier Zapata Rios, Angelica Vazquez-Ortega, Kate Condon, David Huckle, Tom Meixner, Jon Chorover. Do carbon and water fluxes control chemical denudation? Submission planned 11/2013 to Biogeochemistry or GCA.

J.N. Perdrial, Stielstra, C., Lybrand, R. Swetnam, T., Mitra, B., Huckel, D., Harpold, A., J. McIntosh, T. Meixner A. Vasquez-Ortega, K. Condon, P. Brooks, J. Chorover. The impact of land use and climate change on the carbon budget of forested headwater catchments. Submission planned for 10/2013 to PNAS

J. N. Perdrial, Michael Pohlmann, Jessica Prescott-Smith, Jon Chorover. Impact of storm events on stream water DOM characteristics by colloid size fractionation. Submission planned 01/2014 to Hydrological Processes.

SELECTED TALK ABSTRACTS

J.N. Perdrial, A. Vasquez-Ortega, J. McIntosh, A. Harpold, C. Porter, X. Zapata-Rios, L. Guthridge, P. Brooks, J. Chorover (2012). Stream water organic matter characteristics after the Las Conchas wildfire : perspective from the critical zone. GSA meeting Rocky Mountain section, ABQ. May 9-11th.

J. N. Perdrial*, P. Brooks, J. Chorover, K. Condon, A. Harpold, M. Holleran, D. Huckle, R. Lybrand, P. Troch, J. McIntosh, T. Meixner, B. Mitra, M. Pohlmann, C. Rasmussen, T. Swetnam, A. Vasquez-Ortega, X. Zapata-Rios (2012). Do water and carbon fluxes control chemical denudation? Goldschmidt 2012, June 24-29, Montreal.

J.N. Perdrial, P. Brooks, J. Chorover, A. Harpold, I. Heidbuechel, J. McIntosh, J. Ray, X. Zapata-Rios (2011). Impact of water sources & flow paths on carbon in streams of seasonally snow-covered catchments. Goldschmidt 2011, August 14-19, Prague.

J.N.Perdrial, J. McIntosh, P. Brooks, J. Chorover (2010). DOM as a potential tracer for in-stream processes in small mountain catchments (JRB-SCM Critical Zone Observatory). American Geophysical Union, Fall Meeting 2010, abstract #B12A-05

J.N. Berger, L.N. Warr, M-C. Lett and N. Perdrial (2007). Monitoring smectite hydration in the presence of bacteria. 44rd Annual Meeting of the CMS, June 2-7, Santa Fe, New Mexico, USA

J.N. Berger, L.N. Warr, M-C. Lett and N. Perdrial (2007). Effect of bacteria on the water storage and retention capacity of swelling clays. EGU General Assembly, Geophysical Research Abstract, Vol. 9, 04434

J.N.Berger, L.N.Warr, M-C.Lett, N.Perdrial. Smectite hydration, solution chemistry and bacterial activity: interactions in a confined volume system (2006). Bridging Clays, 43rd Annual Meeting of the CMS-4ème Colloque du GFA, June 3-7, Ile d'Oleron, France

Selected Posters:

J.N.Perdrial, Stielstra, C., Lybrand, R. Swetnam, T., Mitra, B., Huckel, D., Harpold, A., J. McIntosh, T. Meixner A .Vasquez-Ortega, K. Condon, P. Brooks, J. Chorover. Closing the Carbon balance for snow dominated headwater catchments in the US SW. Gordon Conference for Catchment Science, Andover NH.

J.N. Perdrial, N. Perdrial, A. Harpold, A. Peterson, A. Vasquez, J. Chorover (2011). Probing dissolved organic matter in the critical zone: a comparison between in situ sampling and aqueous soil extracts. American Geophysical Union, Fall Meeting 2011, abstract #B51A-0385.

Zaharescu, D., Dontsova, K. Chorover, J., Huxman, T. Maier, R., **Perdrial, J.N.** (2011). Effect of Plant-Microbial Associations on Weathering of Basalt, Granite, Schist, and Rhyolite. Goldschmidt Conference abstract.

E. Dolan, **J.N. Perdrial**, A. Vázquez-Ortega, S. Hernández-Ruiz, J. Chorover (2010). Testing the application of Teflon/quartz soil solution samplers for DOM sampling in the Critical Zone: Field and laboratory approaches. Abstract B13D-0510

J. Ray; J.C. McIntosh; **J.N. Perdrial**; P.D. Brooks; J. Chorover; C. Rasmussen; T. Meixner (2010) Sources and Cycling of Carbon in Two Semi-Arid Catchments, Valles Caldera Preserve, NM: Insights From Carbon Isotopes. Abstract B21D-0340.

J.N.Perdrial, L.Warr, J-L Crovisier (2008). Bacteria in backfill materials - effects on radionuclide transport. Geochimica et Cosmochimica Acta Abstract, Volume 72, Issue 12, p.A735.

L.N. Warr, **J.N. Berger** , M-C. Lett, M. Khodja (2007). An experimental study of clay bacterial interaction in Prestige oil. EGU General Assembly, Austria. Geophysical Research Abstract, Vol. 9, 11096

J.N. Berger, L.N.Warr, M-C.Lett N.Perdrial (2006). Monitoring the effect of swelling clay on metal reducing bacteria. EGU General Assembly, Vienna, Austria. Geophysical Research Abstracts, Vol. 8, 09795

J.N. Berger, L.N. Warr, M-C. Lett, J. Duplay (2005). The Influence of *Shewanella Putrefaciens* on the Swelling Behavior of Nontronite in Solution. Green Mountain Clays, 42rd Annual Meeting of the CMS, Burlington, Vermont, USA

CO- ADVISING OF MS AND PHD STUDENTS

Selene Hernandez (PhD)

2010-2011

Clare Stielstra (MS candidate)

2010-2012

Angelica Vazquez-Ortega (PhD candidate)	2010-2013
Xavier Zapata Rios (MS candidate)	2010-
Courtney Porter (MS candidate)	2010-2012
Michael Pohlmann (MS candidate)	2012-
David Huckle (MS candidate)	2012-

UNDERGRADUATE STUDENT ADVISING

Gary Gold, (BS), University of Arizona, Lab assistant	2010
Kelsie LaSharr, (BS), University of Arizona, Lab assistant	2010-
Elizabeth Dolan, Biosphere2 REU student	2010
James Ray, Biosphere2 REU student	2010
John Leedy, University of Arizona, intern	2010
Billy Linker, (MS), University of Arizona Lab and field assistant	2011
Lauren Guthridge (BS), University of Arizona, Lab assistant	2011-2013
Jess Dalesky, Lab assistant	2012
Theresa Lau, Lab assistant	2012-
Jessica Presscott-Smith, Northwestern University, intern	2012
Ben Rynex	2013
Alexander Lopez	2013

TEACHING EXPERIENCE

Methods in Clay Science (assistant, undergraduate level lab course)	2004
Clays in the environment (assistant, mixed level)	2005, 2006
Crystal-chemistry and reactivity of fine particles (assistant, mixed level)	2007
Critical Zone research and integrative sciences (guest lecturer, undergraduate level)	2010- 2012
DOM in seasonally snow-covered mountain catchments (guest lecturer, graduate level)	2011

LAB, FIELD AND GROUP MANAGEMENT

Laboratory assistant at the X-ray diffraction Laboratory, University of Heidelberg	2000-2003
Coordination & management of SCM-JRB CZO sampling & analysis	2010-
Lead of field installation campaigns of SCM-JRB CZO catchments	campaigns: 2010; 2011
Organization of monthly CZO student-postdoc research meetings	2010-
Lead of CZO-synthesis project Carbon balance	2012
Lead of CZO-synthesis project EEMT and chemical denudation	2012

MEMBERSHIPS

Member, Clay Mineral Society of America (2008-present)
 Member, Critical Zone Exploration Network (2010-present)
 Member, European Geochemical Association (2010-present)
 Member, American Geophysical Union (2010-present)
 Member, Soil Science Society of America (2012)

SERVICE

Reviews: Chemical Geology, Clays & Clay Minerals, Environmental Chemistry, Geoderma, Hydrological Processes, International Biodegradation & Biodeterioration, Soil and Sediment Contamination an International Journal

Other service:

Special committee member of oral comprehensive exams, Soil, Water and Environmental Science Dept., 2012
 PhD. Defense committee, Soil, Water and Environmental Science Dept., 2013
 Presentation judge: Earthweek, University of Arizona 2012, 2013; AGU Fall Meeting 2012; Goldschmidt 2012, Montreal.