

Nicholas J. Pester, Ph.D.

Curriculum Vitae

Energy Geosciences Division
Lawrence Berkeley National Laboratory
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EDUCATION AND DEVELOPMENT

Lawrence Berkeley National Laboratory , Berkeley, CA, USA Postdoctoral Fellow - Mentor: Dr. Kevin Knauss	2013–present
University of Minnesota , Minneapolis, MN, USA Ph.D., Geology, Chemistry - Advisor: Prof. William Seyfried, Jr.	2005–2012
Gustavus Adolphus College , St. Peter, MN, USA B.A. (honors), Geology - Thesis work at Macalester College, St. Paul, MN, USA	1996–2000
Southern Illinois University , Carbondale, IL, USA Geology field camp, Montana and Wyoming (6 weeks)	2000
University of Edinburgh , Edinburgh, Scotland Non-graduating studies - School of Geosciences (full academic year)	1998–1999

RESEARCH

General Research Interests

My research is largely focused on the geochemistry of subsurface reactions. I carry out experimental and field investigations pertaining to fluid-mineral equilibria, mass transport of metals and volatile gases, and multi-phase behavior in crustal fluids, both on Earth and other planetary bodies. Specific studies currently include: the chemical evolution of deep-sea hydrothermal fluids and the impacts on associated biota and long term ocean chemistry, the abiotic synthesis and stability of organic compounds, potential reservoir effects related to geological carbon sequestration, partitioning of tracer gases between brines and supercritical CO₂, the effect of matrix cations and gases on the mass transfer of transition/trace metals, the effects of fluid chemistry on sub-critical crack growth in minerals using hydrothermal atomic force microscopy, and competitive sorption of metals on clay minerals using hydrothermal in-situ pH/Eh.

Field Research Experience

Integrated Studies of Deep-Sea Hydrothermal Systems

East Pacific Rise, 9–10°N: Cruise AT-37-04 (<i>R/V Atlantis</i> , <i>DSV Alvin</i>) Lead scientist aboard Alvin dives 4840 and 4843.	2016
East Pacific Rise, 9–13°N: Cruise AT-15-28 (<i>R/V Atlantis</i> , <i>DSV Alvin</i>) Lead scientist aboard Alvin dive 4392.	2008
Mid-Atlantic Ridge, 26–37°N: Cruise KNOX18RR (<i>R/V Roger Revelle</i> , <i>ROV Jason II</i>)	2008

Main Endeavour Field, Juan de Fuca Ridge: Cruise AT-11-31 (<i>R/V Atlantis, DSV Alvin</i>) Starboard scientist aboard Alvin dive 4142	2005
Galapagos Rift: Cruise AT-11-27 (<i>R/V Atlantis, DSV Alvin</i>)	2005
<u>Demonstration Scale Carbon Sequestration</u>	
Stage 2B extension project: CO2CRC Otway project, Victoria Australia	2014

TEACHING EXPERIENCE

Guest Lecturer

Oceanography (1006), University of Minnesota, MN, USA	2009–2012
Oceanography (1120), Normandale College, MN, USA	2009
Geochemical Modeling (5351), University of Minnesota, MN, USA	2008

Writing Instructor

Geochemical Principles (3303W), University of Minnesota, MN, USA	2010
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Teaching Assistant

Oceanography (1006), University of Minnesota, MN, USA	2009–2012
Geochemical Modeling (5351), University of Minnesota, MN, USA	2008

Laboratory Instructor

Oceanography (1006), University of Minnesota, MN, USA	2006–2009
Geology and Cinema (1005), University of Minnesota, MN, USA	2009
Earth and Its Environments (1001), University of Minnesota, MN, USA	2005–2006

Laboratory Curator/Manager

Oceanography (1006), University of Minnesota, MN, USA	2007–2009
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Course Curriculum Development

- Authored/compiled new Oceanography (1006, Univ. of MN) lab manual (2007)
- Planned lectures and student exercises for a new Geochemical Modeling course (5351, Univ. of MN, 2008)

Undergraduate Mentoring

- Annually hosted/sponsored NSF-REU summer research interns (2006–2011)
- Successfully collaborated with a College of Biological Sciences (Univ. of MN) student in funding an Undergraduate Research Opportunity (UROP) in our lab, proposal entitled: *Pyrite oxidation under deep-sea hydrothermal conditions: Potential for the production of hydrogen peroxide* (2009)

AWARDS AND HONORS

Outstanding Student Paper Award (oral presentation), AGU Fall Meeting	2008
William Emmons Fellowship, Univ. of MN	2007–2008
Richard Clarence Dennis Graduate Fellowship, Univ. of MN	2007–2008
Kimball Forrest Fellowship, Univ. of MN	2008–2009
Goldschmidt Student Travel Grant, Geochemical Society	2010, 2011, 2012

Invited Speaker

Graduate School of Oceanography, University of Rhode Island, RI, USA	2016
Center for Isotope Geochemistry, UC Berkeley, CA, USA	2015
Dept. of Earth Sciences, University of Cambridge, Cambridge, UK	2014
21 st Annual V.M. Goldschmidt Conference, Prague, Czech Republic	2011
Geology Seminar, Carleton College, MN, USA	2010
Hard Rock Seminar, University of Minnesota, MN, USA	2009
Soft Rock Seminar, University of Minnesota, MN, USA	2008

PROFESSIONAL SERVICE

Session convener, 27 th V. M. Goldschmidt conference: <i>Seafloor hydrothermal processes on modern and ancient Earth: Implications for life, elemental budgets, and oxidation states of the lithosphere-hydrosphere-atmosphere system</i> (10d)	2017
Science specialist for Pacific Testing, an organization dedicated to developing standardized testing and metrics for Pacific island nations (http://www.pactesting.org)	2016–present
External Reviewer, NSF, Marine Geology and Geophysics	2016
Panelist, NASA Solar System Workings program	2015
Session convener, Fall Meeting, American Geophysical Union: <i>Dynamics of continental and seafloor hydrothermal systems</i> (2512)	2014
Group coordinator, Basic Energy Sciences (geochemistry), LBNL	2014–2016
Manuscript reviewer for: <i>American Mineralogist</i> , <i>Chemical Geology</i> , <i>Earth and Planetary Science Letters</i> , <i>Economic Geology</i> , <i>Geochimica et Cosmochimica Acta</i> , <i>IEEE Transactions on Mechatronics</i> , <i>International Journal of Greenhouse Gas Control</i> , <i>Nature Geoscience</i> , <i>Nature: Scientific Reports</i>	
Member: American Geophysical Union, Geochemical Society, Geological Society of America	

NEW ARTICLES IN PREPARATION

Pester, N. J., A. T. Schaen, K. Ding, W. E. Seyfried, Jr., Quartz solubility and geothermometry in near-critical hydrothermal solutions: Physicochemical implications for mid-ocean ridge metal fluxes over glacial cycles, submission to *Earth and Planetary Science Letters*.

Antonelli, M. A., **N. J. Pester**, S. T. Brown, D. J. DePaolo, The influence of Cretaceous and Paleozoic seawater compositions on chemical and isotopic fluxes from mid-ocean ridge hydrothermal systems, invited submission to *Nature Geoscience*.

Pester, N. J., W. E. Seyfried, Jr., Abiotic formation of CO and light hydrocarbons from precursor CO₂ and H₂ using a hydrothermal flow apparatus: Water-gas-shift equilibrium and rates of CH₄ synthesis, submission to *Geochimica et Cosmochimica Acta*.

Pester, N. J., N. Spycher, B. M. Freifeld, K. G. Knauss, Partitioning of trace noble and light fixed gases between supercritical CO₂ and H₂O: An experimental study at 50-90 °C and 70-200 bars, journal TBD

PUBLICATION HISTORY

Pester, N. J., K. Ding, W. E. Seyfried, Jr. (2015), Vapor-liquid partitioning of alkaline earth and transition metals in NaCl-dominated hydrothermal fluids: An experimental study from 360 to 465 °C, near-critical to halite saturated conditions, *Geochimica et Cosmochimica Acta*, **168**, 111-132.

Seyfried, W. E., Jr., **N. J. Pester**, B. M. Tutolo, K. Ding (2015), The Lost City hydrothermal system: Constraints imposed by vent fluid chemistry and reaction path models on seafloor heat and mass transfer processes, *Geochimica et Cosmochimica Acta*, **163**, 59-79.

Pester, N. J., G. Saldi, N. Lee, K. G. Knauss (2014), Laboratory experiments: Geochemical interactions between CO₂ - saturated brines and sandstone 2-41R, in Mukhopadhyay, S., N. Spycher, **N. Pester**, G. Saldi, J. Beyer, J. Houseworth, & K. Knauss, *Final Report on Experimental and Numerical Modeling Activities for the Newark Basin*. - [Report Number: LBNL-6901E](#), pp. 76-90.

Syverson, D. D., **N. J. Pester**, P. R. Craddock, W. E. Seyfried, Jr. (2014), Fe isotope fractionation during phase separation in the NaCl-H₂O system: An experimental study with implications for seafloor hydrothermal systems, *Earth and Planetary Science Letters*, **406**, 223-232.

Pester, N. J., K. Ding, W. E. Seyfried, Jr. (2014), Magmatic eruptions and iron volatility in deep-sea hydrothermal fluids, *Geology*, **42**, 255-258.

Pester, N. J., E. P. Reeves, M. E. Rough, K. Ding, J. S. Seewald, W. E. Seyfried, Jr. (2012), Subseafloor phase equilibria in high-temperature hydrothermal fluids of the Lucky Strike Seamount (Mid-Atlantic Ridge, 37°17'N), *Geochimica et Cosmochimica Acta*, **90**, 303-322.

Brant, C., L. A. Coogan, K. M. Gillis, W. E. Seyfried, **N. J. Pester**, J. Spence (2012), Lithium and Li-isotopes in young altered upper oceanic crust from the East Pacific Rise, *Geochimica et Cosmochimica Acta*, **96**, 272-293.

Pester, N. J., M. E. Rough, K. Ding, W. E. Seyfried, Jr. (2011), A new Fe/Mn geothermometer for hydrothermal systems: Implications for high-salinity fluids at 13°N on the East Pacific Rise. *Geochimica et Cosmochimica Acta*, **75**, 7881-7892.

Wu, S., C. Yang, **N. Pester**, Y. Chen (2011), A new hydraulically actuated titanium sampling valve for a deep-sea hydrothermal fluid sampler. *IEEE Journal of Oceanic Engineering*, **36**, 462-469.

Seyfried W. E., Jr., **N. J. Pester**, K. Ding, M. Rough (2011), Vent fluid chemistry of the Rainbow hydrothermal system (36°N, MAR): Phase equilibria and in-situ pH controls on seafloor alteration processes. *Geochimica et Cosmochimica Acta*, **75**, 1574-1593.

Seyfried, W. E., Jr., **N. J. Pester**, Fu Qi (2010), Phase equilibria controls on the chemistry of vent fluids from hydrothermal systems on slow spreading ridges: Reactivity of plagioclase and olivine solid solutions and the pH-silica connection, in *Diversity of Hydrothermal Systems on Slow Spreading Ocean Ridges*, *Geophys. Monogr. Ser.*, **188**, edited by P. Rona, C. Davey, J. Dymont and B. Murton, pp. 297-320, AGU, Washington, D.C.

Foustoukos, D.I., **N. J. Pester**, K. Ding, W.E. Seyfried, Jr. (2009), Dissolved carbon species in associated diffuse and focused flow hydrothermal vents at the Main Endeavour Field, Juan de Fuca Ridge: Phase equilibria and kinetic constraints, *Geochemistry, Geophysics, Geosystems*, **8**, Q10003, doi: [1029/2009/GC002472](https://doi.org/10.1029/2009/GC002472).

Pester, N. J., D. A. Butterfield, D. I. Foustoukos, K. K. Roe, K. Ding, T. M. Shank, W. E. Seyfried, Jr. (2008), The chemistry of diffuse-flow vent fluids on the Galapagos Rift (86°W): Temporal variability and subseafloor phase equilibria controls, in *Magma to Microbe: Modeling Hydrothermal Processes at Oceanic Spreading Centers*, *Geophys. Monogr. Ser.*, **178**, edited by R. P. Lowell, J. S. Seewald, M. R. Perfit and A. Metaxas, pp. 123-144, AGU, Washington, D.C.

CONFERENCE PROCEEDINGS/ABSTRACTS

Pester, N. J., D. D. Syverson, J. A. Higgins, W. E. Seyfried, Jr. (2016), Ca and Sr isotope systematics in mid-ocean ridge hydrothermal fluids, Abstract V53E-02, presented at the 2016 Fall Meeting, AGU: San Francisco, CA, USA, 12-16 Dec.

Syverson, D. D., P. Scheuermann, **N. J. Pester**, J. A. Higgins, W. E. Seyfried, Jr. (2016), Ca isotope fractionation and Sr/Ca partitioning associated with anhydrite formation at mid-ocean ridge hydrothermal systems: An experimental approach, Abstract V51A-3055, presented at the 2016 Fall Meeting, AGU: San Francisco, CA, USA, 12-16 Dec.

Antonelli, M. A., D. J. DePaolo, S. T. Brown, **N. J. Pester**, E. Sonnenthal (2016), Effect of paleoseawater composition on hydrothermal outputs at mid-ocean ridges, *Goldschmidt Abstracts, 2016*. Paper presented at the 26th V.M. Goldschmidt conference, Yokohama, Japan, 26 June-1 July.

Pester, N. J., W. E. Seyfried, Jr. (2015), Abiotic hydrocarbon synthesis using a hydrothermal flow reactor: Implications of the C1/C2 ratio, *Goldschmidt Abstracts, 2015 2466*. Paper presented at the 25th V.M. Goldschmidt conference, Prague, Czech Republic, 16-21 Aug.

Pester, N. J., A. T. Schaen, K. Ding, W. E. Seyfried, Jr. (2014), Experimental constraints on hydrothermal circulation in mid-ocean ridges, *Goldschmidt Abstracts, 2014 1943*. Paper presented at the 24th V.M. Goldschmidt conference, Sacramento, CA, USA, 9-13 Jun.

Seyfried, W. E., Jr., **N. J. Pester**, K. Ding (2014), Geochemical controls on the composition of hydrothermal vent fluids at mid-ocean ridges (*keynote*), *Goldschmidt Abstracts, 2014 2254*. Paper presented at the 24th V.M. Goldschmidt conference, Sacramento, CA, USA, 9-13 Jun.

Seyfried, W. E., Jr., **N. J. Pester**, K. Ding (2012), Ultramafic-hosted hydrothermal systems at mid-ocean ridges: Serpentinization, chloritization and geochemical controls on mass-transfer processes (*invited*), Abstract V52A-01 presented at the 2012 Fall Meeting, AGU: San Francisco, CA, USA, 3-7 Dec.

Pester, N. J., K. Ding, W. E. Seyfried, Jr. (2012), Experimental vapor-liquid partitioning of transition metals in NaCl dominated fluids, *Mineralogical Magazine*, **76**(6) 2223. Paper presented at the 22nd V.M. Goldschmidt conference, Montreal, Canada, 25-29 Jun.

Pester, N. J., W. E. Seyfried, Jr. (2011), Kinetic and thermodynamic controls on the concentration of carbon gases in hydrothermal fluids, *GSA Abstracts with Programs*, 43, 532. Paper 220-11 presented at the GSA annual meeting and exposition, Minneapolis, MN, USA, 9-12 Oct.

Pester, N. J., W. E. Seyfried, Jr. (2011), Abiogenic formation of carbon species at hydrothermal conditions using a novel flow apparatus, *Mineralogical Magazine*, 75(3), 1626. Paper presented at the 21st V.M. Goldschmidt conference, Prague, Czech Republic, 14-19 Aug. (**invited presentation**)

Pester, N.J., W. E. Seyfried, Jr. (2010), Vapor-liquid partitioning of iron and manganese in hydrothermal fluids: An experimental investigation with application to the integrated study of basalt-hosted hydrothermal systems, Abstract OS14A-03 presented at the 2010 Fall Meeting, AGU: San Francisco, CA, USA, 13-17 Dec.

Pester, N. J., M. E. Rough, K. Ding, W. E. Seyfried, Jr. (2010), Phase equilibria controls on mass transfer reactions in the Rainbow hydrothermal system, *Geochimica et Cosmochimica Acta*, 74, A809. Paper presented at the 20th V.M. Goldschmidt conference, Knoxville, TN, USA, 13-18 Jun.

Ding, K., W. E. Seyfried, Jr., **N. J. Pester**, E. Seyfried (2010), A new approach for deducting in-situ pH value of hydrothermal fluid in the reaction zone at mid-ocean ridges, *Geochimica et Cosmochimica Acta*, 74, A234. Paper presented at the 20th V.M. Goldschmidt conference, Knoxville, TN, USA, 13-18 Jun.

Pester, N. J., W. E. Seyfried, Jr. (2009), Possible phase separation effects on the Na/Ca ratio in mid-ocean ridge hydrothermal vent fluids. Abstract presented at the Ridge 2000 workshop: *Devolping a holistic view of oceanic spreading center processes*, St. Louis, MO, USA, 1-3 Oct.

Pester, N. J., K. Ding, W. E. Seyfried, Jr. (2009), Recent hydrothermal fluid chemistry from EPR 13°N: Phase equilibria constraints with applicability to the integrated study of basalt-hosted hydrothermal systems, *Eos, Trans. Am. Geophys. Union*, 90 (52), Fall Meet. Suppl., Abstract OS12A-05 presented at the annual fall meeting of the American Geophysical Union, San Francisco, CA, USA, 14-18 Dec.

Pester, N. J., M. Rough, K. Ding, W. E. Seyfried, Jr. (2008), Phase equilibria controls on fluid chemistry at the Lucky Strike hydrothermal field, Mid-Atlantic Ridge, *Eos, Trans. Am. Geophys. Union*, 89 (53), Fall Meet. Suppl., Abstract V54B-06 presented at the annual fall meeting of the American Geophysical Union, San Francisco, CA, USA, 15-19 Dec. (**outstanding student presentation award**)

Seyfried, W. E., Jr., K. Ding, **N. Pester**, Q. Fu. (2008), Geochemical controls on the composition of hydrothermal vent fluids at EPR 9°N: pH and redox constraints from in situ chemical sensor deployments and experimental and theoretical model results (*invited*), *Eos, Trans. Am. Geophys. Union*, 89 (53), Fall Meet. Suppl., Abstract V44B-04 presented at the annual fall meeting of the American Geophysical Union, San Francisco, CA, USA, 15-19 Dec.

Ding, K., W. E. Seyfried, **N. Pester**, E. Seyfried (2008), In-situ measurement of pH of hydrothermal vent fluids at EPR 9°N: Implications for acidity in seafloor reaction zones, *Eos, Trans. Am. Geophys. Union*, 89 (53), Fall Meet. Suppl., Abstract B21A-0333 presented at the annual fall meeting of the American Geophysical Union, San Francisco, CA, USA, 15-19 Dec.

Pester, N. J., D. A. Butterfield, D. I. Foustoukos, K. K. Roe, K. Ding, T. M. Shank, W. E. Seyfried, Jr. (2007), The chemistry of diffuse-flow vent fluids on the Galapagos Rift (86°W): Temporal variability and seafloor phase equilibria controls, *Geochimica et Cosmochimica Acta*, 71, A780. Paper presented at the 17th V.M. Goldschmidt conference, Cologne, Germany, 19-24 Aug.

Foustoukos, D. I., W. E. Seyfried, K. Ding, **N. Pester** (2006), Dissolved carbon species in diffuse and focused flow hydrothermal vents at the Main Endeavour Field, Northern Juan de Fuca Ridge, *Eos, Trans. Am. Geophys. Union*, 87 (52), Fall Meet. Suppl., Abstract B34A-03 presented at the annual fall meeting of the American Geophysical Union, San Francisco, CA, USA, 11-15 Dec.

Ding, K., W. E. Seyfried, Z. Zhang, D. Foustoukos, **N. J. Pester** (2006), Redox and pH evolution of the seafloor hydrothermal system at the Main Endeavour Field, JDF: Constraints from time series measurement using in-situ chemical sensors, *Eos, Trans. Am. Geophys. Union*, 87 (52), Fall Meet. Suppl., Abstract B31B-1106 presented at the annual fall meeting of the American Geophysical Union, San Francisco, CA, USA, 11-15 Dec.