

Curriculum Vitae: Martin Appold

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EDUCATIONAL AND PROFESSIONAL HISTORY

Education

- 1998 Ph.D., Hydrogeology/Geochemistry, Johns Hopkins University
 Supervisor: Dr. Grant Garven
- 1992 M.S., Economic Geology/Geochemistry, University of Michigan
 Supervisor: Dr. Stephen Kesler
- 1990 B.A., Geology, cum laude, Washington University

Positions

- 2010-present Associate Professor, University of Missouri—Columbia
- 2004-2010 Assistant Professor, University of Missouri—Columbia
- 1999-2004 Visiting Assistant Professor, University of Iowa
- 1998-1999 Post-Doctoral Fellow, Louisiana State University
 Supervisor: Dr. Jeffrey Nunn
- 1998 Hydrologist, Maryland Geological Survey

SCHOLARSHIP

Refereed Publications

- Ahmmmed, B., **Appold, M. S.**, Fan, T., McPherson, B. J. O. L., Grigg, R. B., White, M. D., 2016, Chemical effects of CO₂ sequestration in the Upper Morrow Sandstone in the Farnsworth, Texas hydrocarbon unit: *Environmental Geosciences Journal*, v. 23, p. 81-93.
- Joshi, A., **Appold, M. S.**, 2016, Numerical modeling of porosity waves in the Nankai accretionary wedge décollement, Japan: implications for aseismic slip: *Hydrogeology Journal*, DOI: 10.1007/s10040-016-1479-7.

- Joshi, A., **Appold, M. S.**, 2016, Potential of porosity waves for methane transport in the Eugene Island field of the Gulf of Mexico basin: *Marine and Petroleum Geology*, v. 75, p. 1-13.
- Pan, F., McPherson, B. J., Esser, R., Xiao, T., **Appold, M. S.**, Jia, W., Moodie, N., 2016, Forecasting evolution of formation water chemistry and long-term mineral alteration for GCS in a typical clastic reservoir of the southwestern United States: *International Journal of Greenhouse Gas Control*, DOI: 10.1016/j.ijggc.2016.07.035.
- Pelch, M. A., **Appold, M. S.**, Emsbo, P., Bodnar, R. J., 2015, Constraints from fluid inclusion compositions on the origin of Mississippi Valley-type mineralization in the Illinois-Kentucky district: *Economic Geology*, v. 110, p. 787-808.
- Burrows, C. R., **Appold, M. S.**, 2015, Hydrology of the Forest City Basin, Mid-Continent, USA: Implications for CO₂ Sequestration in the St. Peter Sandstone: *Environmental Earth Sciences*, v. 73, p. 1409-1425.
- Ingebritsen, S. E., **Appold, M. S.**, 2012, The physical hydrogeology of ore deposits: *Economic Geology*, v. 107, p. 559-584.
- Joshi, A., **Appold, M. S.**, Nunn, J. A., 2012, Evaluation of solitary waves as a mechanism for oil transport in poroelastic media: a case study of the South Eugene Island field, Gulf of Mexico basin: *Marine and Petroleum Geology*, v. 37, p. 53-69.
- Wenz, Z. J., **Appold, M. S.**, Shelton, K. L., Tesfaye, S., 2012, Geochemistry of Mississippi Valley-type mineralizing fluids in the Ozark Plateau: a regional synthesis: *American Journal of Science*, v. 312, p. 22-80.
- Shelton, K. L., Beasley, J. M., Gregg, J. M., **Appold, M. S.**, Crowley, S. F., Hendry, J. P., Somerville, I. D., 2011, Evolution of a Carboniferous carbonate-hosted sphalerite breccia deposit, Isle of Man: *Mineralium Deposita*, v. 46 p. 859-880.
- Appold, M. S.**, Wenz, Z. J., 2011, Composition of ore fluid inclusions from the Viburnum Trend, Southeast Missouri district, USA: implications for transport and precipitation mechanisms: *Economic Geology*, v. 106, p. 55-78.
- Appold, M. S.**, Monteiro, L. V. S., 2009, Numerical modeling of hydrothermal mineralization in the Vazante zinc deposit, Brazil: *Geofluids*, v. 9, p. 96-115.
- Appold, M. S.**, Nabelek, P. I., 2009, Introduction to the special issue on numerical modeling of hydrothermal fluids: *Geofluids*, v. 9, p. 77-84.
- Wilkinson, J. J., Stoffell, B., Wilkinson, C. C., Jeffries, T. E., **Appold, M. S.**, 2009, Anomalously metal-rich fluids form hydrothermal ore deposits: *Science*, v. 323, p. 764-767.
- Stoffell, B., **Appold, M. S.**, Wilkinson, J. J., McClean, N. A., Jeffries, T. E., 2008, Geochemistry and evolution of Mississippi Valley-type mineralizing brines from the Tri-State and Northern Arkansas districts determined by LA-ICP-MS microanalysis of fluid inclusions: *Economic Geology*, v. 103, p. 1411-1435.
- Harkins, S. A., **Appold, M. S.**, Nelson, B. K., Brewer, A. M., Groves, I. M., 2008, Lead isotope constraints on the origin of non-sulfide zinc and sulfide zinc-lead deposits in the Flinders Ranges, South Australia: *Economic Geology*, v. 102, p. 353-364.
- Appold, M. S.**, Garven, G., Boles, J. R. and Eichhubl, P., 2007, Numerical modeling of the origin of calcite mineralization in the Refugio-Carneros fault, Santa Barbara basin, California: *Geofluids*, v. 7, p. 79-95.
- Appold, M. S.**, Nunn, J. A., 2005, Hydrology of the western Arkoma basin and Ozark platform during the Ouachita orogeny: implications for Mississippi Valley-type ore formation in the Tri-State Zn-Pb district: *Geofluids*, v. 5, p. 308-325.
- Appold, M. S.**, Numelin, T. J., Shepherd, T. J., Chenery, S. R., 2004, Limits on the metal content of fluid inclusions

in gangue minerals from the Viburnum Trend, Southeast Missouri determined by laser ablation ICP-MS: *Economic Geology*, v. 99, p. 185-198.

Stoffell, B., Wilkinson, J. J., Jeffries, T. E., **Appold, M.**, 2004, 213-nm UV laser ablation microanalysis of fluid inclusions; development and application, in Muhling, J., Goldfarb, R. J., Vielreicher, N., Bierlein, F. P., Stumpfl, E. F., Groves, D. L., Kenworth, S., Knox-Robinson, C. M., eds., Predictive Mineral Discovery under Cover, Conference Proceedings of Society of Economic Geologists, September 27-October 1, 2004, Perth, Western Australia: Publication - Geology Department and Extension Service, University of Western Australia, 2004, v. 33, p. 391-394.

Appold, M. S., Nunn, J. A., 2002, Numerical models of petroleum migration via buoyancy-driven porosity waves in viscously deformable sediments: *Geofluids*, v. 2, p. 233-247.

Appold, M. S., Garven, G., 2000, Reactive flow models of ore formation in the Southeast Missouri district: *Economic Geology*, v. 95, p. 1605-1626.

Appold, M. S., Garven, G., 1999, The hydrology of ore formation in the Southeast Missouri district: numerical models of topography-driven fluid flow during the Ouachita orogeny: *Economic Geology*, v. 94, p. 913-936.

Garven, G., **Appold, M. S.**, Toptygina, V. I., and Hazlett, T. J., 1999, Hydrogeologic modeling of the genesis of carbonate-hosted lead-zinc ores: *Hydrogeology Journal*, v. 7, p. 108-126.

Appold, M.S., Garven, G., 1998, Effects of fluid flow and temperature variations on lead mineralization in the Southeast Missouri ore district: *Ninth International Symposium on Water-Rock Interactions, Conference Proceedings*, Taupo, New Zealand, p. 513-516.

Kesler, S.E., Martini, A.M., **Appold, M.S.**, Walter, L.M., Huston, T.J., Furman, F.C., 1996, Na-Cl-Br systematics of fluid inclusions from Mississippi Valley-type deposits, Appalachian Basin: Constraints on solute origin and migration paths: *Geochimica et Cosmochimica Acta*, v. 60, p. 225-233.

Appold, M.S., Kesler, S.E., Alt, J.C., 1995, Sulfur isotope and fluid inclusion constraints on the genesis of Mississippi Valley-type mineralization in the Central Appalachians: *Economic Geology*, v. 90, p. 902-919.

Kesler, S.E., **Appold, M.S.**, Martini, A.M., Walter, L.M., Huston, T.J., Kyle, J.R., 1995, Na-Cl-Br systematics of mineralizing brines in Mississippi Valley-type deposits: *Geology*, v. 23, p. 641-644.

Kesler, S.E., **Appold, M.S.**, Cumming, G.L., Krstic, D., 1994, Lead isotope geochemistry of Mississippi Valley-type mineralization in the Central Appalachians: *Economic Geology*, v. 89, p. 1492-1500.

Kesler, S. E., Cumming, G. L., Krstic, D., **Appold, M. S.**, 1994, Lead isotope geochemistry of Mississippi Valley-type deposits of the Southern Appalachians: *Economic Geology*, v. 89, p. 307-321.

Submitted Manuscripts under Review, in Revision, or in Press

Kenderes, S. M., Appold, M. S., (under review), Fluorine concentrations of ore fluids in the Illinois-Kentucky district: Evidence from SEM-EDS analysis of fluid inclusion decrepitates: *Geochimica et Cosmochimica Acta*.

Mohammadi, S., Gregg, J. M., Shelton, K. L., **Appold, M. S.**, Puckette, J. O., (in press), Influence of late diagenetic fluids on Mississippian carbonate rocks on the Cherokee – Ozark Platform, NE Oklahoma, NW Arkansas, SW Missouri, and SE Kansas: *American Association of Petroleum Geologists Bulletin*.

Unrefereed Publications

White, M. D., McPherson, B. J., Grigg, R. B., Ampomah, W., **Appold, M. S.**, 2014, Numerical simulation of carbon dioxide injection in the western section of the Farnsworth Unit: *Energy Procedia* (Open Access).

Appold, M. S., 2013, Book review: *Frontiers in Geofluids*, edited by Bruce Yardley, Craig Manning, and Grant Garven (Wiley-Blackwell, 2011): *Hydrogeology Journal*, v. 21, p. 521-522.

Appold, M. S., 2001, Reactive transport modeling of ore formation by groundwater mixing in the Southeast Missouri district: *The Gangue*, Issue 68, p. 3-5.

Conference Presentations (First author only)

Appold, M. S., 2016, Concentrations of fluorine in magmatic and Mississippi Valley-type ore fluids in the Illinois-Kentucky fluorite-Zn-Pb-Ba district: Implications for ore formation: *American Geophysical Union*, San Francisco, CA, December 13, 2016.

Appold, M. S., 2016, How metal-rich are the fluids that form carbonate-hosted Zn-Pb ore deposits?: *Pan-American Current Research on Fluid Inclusions XIII*, Columbia, Missouri, May 25, 2016.

Appold, M. S., 2015, How Zn-Pb-rich are sedimentary brines that form carbonate hosted Zn-Pb ore deposits? Recent progress and unresolved questions: *Geological Society of America, Abstracts with Programs*, v. 47, 83-4.

Appold, M., Field, J., Coveney, R., 2015, Origin of Mississippi Valley-type deposits in the U.S. mid-continent: Insights from trace occurrences of mineralization: *Goldschmidt Conference*, Prague, Czech Republic, August, 20, 2015.

Appold, M. S., Joshi, A., 2015, Porosity waves: A mechanism for enhanced fluid transport in overpressured aquitards in sedimentary basins: *42nd International Association of Hydrogeologists Congress*, Rome, Italy, September 15, 2015.

Appold, M. S., Joshi, A., 2014, Solitary waves: a possible mechanism for rapid fluid transport in low permeability porous media: *European Geosciences Union*, Vienna, Austria, May 1, 2014.

Appold, M. S., Prokof, D. J., Monteiro, L. V. S., Bodnar, R. J., 2013, Constraints from fluid inclusions on the origin of the Morro Agudo Zn-Pb deposit in the Vazante-Unai trend, central Brazil: *European Current Research on Fluid Inclusions*, Antalya, Turkey, June 9, 2013.

Appold, M. S., Prokof, D. J., Monteiro, L. V. S., Bodnar, R. J., 2013, ore fluid composition and genesis of the Morro Agudo Zn-Pb deposit, central Brazil: *Geological Society of America, Abstracts with Programs*, v. 45, p 425.

Appold, M. S., Wenz, Z. J., Pelch, M. A., 2012, Origin of Mississippi Valley-type deposits in the Ozark and Interior Low Plateaus, U.S. mid-continent [**invited**]: constraints from fluid inclusions: *Pan American Current Research on Fluid Inclusions*, Windsor, Ontario, Canada, June, 19, 2012.

Appold, M. S., Wenz, Z. J., Pelch, M. A., 2012, Origin of Mississippi Valley-type deposits in the Ozark and Interior Low Plateaus, U.S. mid-continent: constraints from fluid inclusions [**invited**]: *Goldschmidt Conference*, Montreal, Quebec, Canada, June, 25, 2012.

Appold, M. S., Leatherman, M. A., 2012, Numerical modeling of the Beowawe, Nevada epithermal system: *Gordon Research Conference on Geochemistry of Mineral Deposits*, Andover, NH, July 15-20, 2012.

Appold, M. S., Joshi, A., Nunn, J. A., 2012, Oil transport by solitary waves in elastic porous media: a case study of the Eugene Island Field, Gulf of Mexico basin: *Geological Society of America, Abstracts with Programs*, v. 44, 205-1.

Appold, M. S., 2011, Solitary waves as agents of enhanced fluid transport in elastic low-permeability porous media:

- a case study based on the Eugene Island hydrocarbon field in the Gulf of Mexico basin: *U.S. Geological Survey Hubbert Quorum*, Menlo Park, CA, December 3, 2011.
- Appold, M.S., 2010, Fluid inclusion and zinc ore mineral geochemistry of the Vazante deposit, Brazil: *Geological Society of America, Abstracts with Programs*, v. 42, 226-2.
- Appold, M. S., Wenz, Z. J., 2009, Implications of Pb-rich fluid inclusions from Mississippi Valley-type ore deposits of the Viburnum Trend, Southeast Missouri: *Geological Society of America, Abstracts with Programs*, v. 41, 93-3.
- Appold, M. S., 2008, Solitary waves as agents of hydrocarbon transport in basin sediments with viscous and visco-elastic rheologies: Hubbert Quorum, U.S. Geological Survey—Menlo Park, CA, December 14, 2008.
- Appold, M. S., 2008, Geochemical modeling of zinc silicate ore formation from sedimentary hydrothermal fluids: *American Geophysical Union*, San Francisco, CA, December 15, 2008.
- Appold, M. S., 2007, Numerical modeling of hydrothermal mineralization in the Vazante zinc deposit, Brazil: *Geological Society of America, Abstracts with Programs*, v. 39, 127-13.
- Appold, M. S., Stoffell, B., Wilkinson, J., 2007, Evidence and implications of invasion of a metal-enriched fluid during Mississippi Valley-type mineralization in the southwestern Ozark Plateau: *Geological Society of America, South Central-North Central Meeting*, Lawrence, Kansas, April 12, 2007.
- Appold, M. S., Garven, G., Boles, J. R., Eichhubl, P., 2007, Numerical modeling analysis of the role of episodic fault overpressuring and rupture in methane transport and massive calcite cementation in the Santa Barbara basin, California: *American Association of Petroleum Geologists* (Long Beach, CA), April 3, 2007.
- Appold, M. S., Enright, R., Galicki, S., Isiorho, S., LaSage, D., Lepper, K., Reichard, J., Sims, W. J., Wang, H., Yelderman, J., 2006, Teaching hydrogeology in the 21st century: Resources demonstrating the interface between hydrogeology and other scientific and social disciplines: *Geological Society of America, Abstracts with Programs*, v. 38, 174-4.
- Appold M. S., Garven G., Boles J. R. Eichhubl, P., 2005, Numerical reactive transport modeling of the effects of leakage of methane-rich fluids along the Refugio-Carneros fault in the Santa Barbara basin: *Geological Society of America, Abstracts with Programs*, v. 37, 19-5.
- Appold M., Stoffell B., Cachine J., McClean N., Wilkinson J., 2005, Composition and fluid-rock interactions of mineralizing brines in the Tri-State Zn-Pb district: contributions from laser ablation ICP-MS and reactive transport modeling: *Gordon Research Conference in Inorganic Geochemistry* (Andover, New Hampshire).
- Appold, M. S., Stoffell, B., Cachine, J., McClean, N. and Wilkinson, J., 2005, Composition, temperature, and behavior of mineralizing brines in the Tri-State Zn-Pb district: contributions from fluid inclusion analysis and reactive transport modeling: *Geological Society of America, Abstracts with Programs*, v. 37, 235-13.
- Appold, M. S., Garven, G., Boles, J. R., Eichhubl, P., 2004, Reactive transport modeling of the role of methane-rich fluids in mineralization of the Refugio-Carneros fault, Santa Barbara basin, California: *Geological Society of America Abstracts with Programs*, v. 36, 135-9.
- Appold, M.S., Garven, G., Boles, J. R., Eichhubl, P., 2004, Numerical modeling of the flow and reaction of methane-rich fluids in Tertiary hydrocarbon fields of the Santa Barbara basin, offshore California: *EOS, Transactions of the American Geophysical Union*, v. 85, H00-2721.
- Appold, M. S. and Nunn, J. A., 2003, Hydrology of the western Arkoma basin during the Ouachita orogeny: implications for Mississippi Valley-type ore formation in the Tri-State Zn-Pb district: *Geological Society of America Abstracts with Programs*, v. 35, 80-13.

- Appold, M. S., Numelin, T. J., Shepherd, T. J., Chenery, S. R., 2002, Limits on the metal content of fluid inclusions in gangue minerals from the Viburnum Trend, Southeast Missouri determined by laser ablation ICP-MS: *Geological Society of America Abstracts with Programs*, v. 34, p. 113.
- Appold, M. S. and Nunn, J. A., 2002, Numerical modeling of the generation and flow of petroleum in viscously deformable sediments: *American Association of Petroleum Geologists, Annual Meeting Expanded Abstracts*, v. 2002. p. 8.
- Appold, M. S., 2001, Reactive transport modeling of MVT ore formation in a tectonically-generated topography-driven flow system [invited]: *Gordon Research Conference* (Andover, NH).
- Appold, M. S. and Nunn, J. A., 2000, Buoyancy-driven porosity migration through viscously deformable sediments: a mechanism for the transport of hydrocarbons and brines: *Geological Society of America Abstracts with Programs*, v. 32, p. A494.
- Appold, M. S., 2000, Reactive transport modeling of ore formation by groundwater mixing in the southeast Missouri district [invited]: *Geocanada 2000*, 4 p. (Calgary).
- Appold, M. S. and Nunn, J. A., 1999, Solitary waves as agents of primary hydrocarbon transport in the Gulf of Mexico basin: *EOS, Transactions, American Geophysical Union*, v. 80, p. F1032.
- Appold, M. S. and Garven, G., 1997, Geochemical and fluid dynamics of ore formation in the Southeast Missouri district: *Gordon Research Conference* (Henneker, NH).
- Appold, M.S. and Garven, G., 1996, Modeling heat and reactive solute transport in the Arkoma Basin, USA: Implications for ore formation in the Southeast Missouri lead district: *Geological Society of America Abstracts with Programs*, v. 28, p. 131.
- Appold, M.S., Garven, G., and Sverjensky, D.A., 1995, Two-dimensional coupled hydrologic and geochemical modeling of mixing-induced mineralization in the Viburnum Trend, Southeast Missouri: *International Field Conference on Carbonate-Hosted Lead-Zinc Deposits*, p. 3-5 (St. Louis).
- Appold, M.S. and Garven, G., 1995, Modeling the effects of fluid mixing and permeability heterogeneities on ore deposition in the Viburnum Trend, Southeast Missouri: *Geological Society of America Abstracts with Programs*, v. 27, p. 67.
- Appold, M.S., Kesler, S.E., and Alt, J.C., 1992, Sulfur isotopic study of Mississippi Valley-type mineralization in the Central and Southern Appalachians: *Geological Society of America Abstracts with Programs*, v. 24, p. 353.

GRANTS

External Grants

Title: Geochemical analysis of fluid inclusions in trace and minor Mississippi Valley-type Zn-Pb occurrences in the US mid-continent: implications for crustal metal enrichment processes
Source: National Science Foundation
Role: Principal Investigator
Amount: \$265,220 (MU share = \$230,881)
Duration: July 15, 2013 to June 30, 2016 (no-cost extension to December 31, 2016)

Title: Southwest Partnership on Carbon Sequestration, Phase III: CO₂ Injection at Farnsworth, Texas
Source: U.S. Department of Energy subaward through New Mexico Institute of Mining & Technology
Role: Principal Investigator
Amount: \$272,187

Duration: September 1, 2012 to December 31, 2017

Title: MRI: Acquisition of laser ablation-multicollector-inductively coupled plasma mass spectrometer (LA-MC-ICPMS)

Source: National Science Foundation

Role: Co-Principal Investigator

Amount: \$713,930

Duration: September 1, 2009 to July 31, 2011

Title: Assessing the environmental impact of the abandoned mines of the central Missouri mining district

Source: U.S. Department of Agriculture, funds granted to and administered through Lincoln University in Jefferson City, Missouri

Role: Co-Investigator

Amount: University of Missouri share = \$19,000; Grant total = \$110,000

Duration: June 1, 2009 to May 31, 2010

Title: Southwest Partnership on carbon sequestration—Phase III, Budget Period 3

Source: U.S. Department of Energy subaward through New Mexico Institute of Mining & Technology

Role: Principal Investigator on subaward

Amount: \$52,513 (includes \$13,750 University of Missouri cost-share)

Duration: April 1, 2009 to September 30, 2009

Title: Collaborative research: time-dependent hydrothermal convection within the Great Basin, Nevada

Source: National Science Foundation

Role: Co-Principal Investigator

Amount: \$59,167

Duration: October 1, 2008 to September 30, 2010

Title: Evaluation of the origin and hydrocarbon transport capabilities of solitary waves in fault conduits with visco-elastic rheologies

Source: U.S. Department of Energy

Role: Principal Investigator

Amount: \$192,397

Duration: June 15, 2008 to June 14, 2010

Title: Fluid inclusion geochemistry of contrasting types of zinc mineralization in the Bambuí sedimentary basin, Brazil

Source: American Philosophical Society Franklin Research Grant

Role: Principal Investigator

Amount: \$5,000

Duration: May 8, 2007 to September 30, 2009

Title: Comparative analysis of fluid inclusion geochemistries from world-class and small-scale Zn-Pb deposits in the Ozark Plateau using laser ablation ICP-MS and Raman spectroscopy

Source: U.S. Geological Survey Mineral Resources External Research Program

Role: Principal Investigator

Amount: \$77,688

Duration: July 24, 2006 to July 23, 2007 (no cost extension to December 31, 2008)

Title: Fluid inclusion and Pb isotope analysis of sulfide and non-sulfide Zn-Pb deposits in the Flinders Ranges, South Australia

Source: Perilya Mining, Ltd.

Role: Principal Investigator

Amount: \$8,000

Duration: September 1, 2005 to June 30, 2006

Title: Determination of the compositions of fluid inclusions and dolomite cements from the Southeast Missouri Pb district

Source: Cominco American Mining, Inc.
Role: Principal Investigator
Amount: \$5,000
Duration: September 1, 2000 to December 31, 2001

Internal Grants

Title: Numerical evaluation of solitary waves as agents of methane transport in sedimentary basins
Source: University of Missouri—Columbia Research Council
Role: Principal Investigator
Amount: \$5700
Duration: June 1, 2012 to August 31, 2012

Title: Analysis of the Composition of Ore Fluids from the Vazante-Unaí Zinc District, Brazil
Source: University of Missouri—Columbia Arts & Sciences Alumni Award
Role: Principal Investigator
Amount: \$1380
Duration: February 6, 2012 to June 30, 2013

Title: Rubidium-strontium radiometric dating of the Vazante zinc ore deposit in southeastern Brazil
Source: University of Missouri—Columbia Wallace Research Enhancement Award
Role: Principal Investigator
Amount: \$2,300
Duration: April 15, 2009 to June 30, 2009

Title: Determination of the sulfur concentration, pH, and redox potential of ore fluids from zinc-lead deposits in the Ozark and Interior Low Plateaus
Source: University of Missouri—Columbia Wallace Research Enhancement Award
Role: Principal Investigator
Amount: \$1,353
Duration: May 1, 2006 to June 30, 2007

Title: Attendance of training course in TOUGH2 multi-phase fluid and heat flow modeling software
Source: University of Missouri—Columbia Faculty Development Project Award
Role: Principal Investigator
Amount: \$2,110
Duration: July 1, 2006 to December 31, 2006

Title: Analysis of the composition and temperature of ore fluids in the Illinois-Kentucky fluorite district
Source: University of Missouri—Columbia Arts & Sciences Alumni Association
Role: Principal Investigator
Amount: \$1,465
Duration: February 1, 2006 to June 30, 2007

Title: Origin of non-sulfide zinc deposits in the Aroona Trend, South Australia
Source: University of Missouri—Columbia Research Council
Role: Principal Investigator
Amount: \$7,500
Duration: May 1, 2005 to June 30, 2006

Title: Purchase of petrographic microscopes and video equipment
Source: University of Iowa College of Liberal Arts Instructional Equipment Grant
Role: Co-Principal Investigator
Amount: \$28,255
Duration: March 15, 2001 to June 30, 2001

Title: Purchase of seismic processing software for Geophysical Subsurface Analysis course

Source: University of Iowa College of Liberal Arts Small Equipment Grant
Role: Principal Investigator
Amount: \$10,000
Duration: October 15, 1999 to December 31, 1999

AWARDS

Julian Boldy Award in Mineral Deposits Research, 2000: Geological Association of Canada

TEACHING

Graduate Students Supervised

Name: Ramazan Ertugrul
Program: Master's of Science degree in Geological Sciences
Project title: Application of Numerical 2D Basin Modeling of Farnsworth Unit, Ochiltree, TX
Role: Co-principal advisor (with Alan Whittington)
Duration: January 15, 2016 to May 15, 2016

Name: Riaz Khan
Program: Master's of Science degree in Geological Sciences
Project title: Numerical reactive transport modeling of CO₂ sequestration in the Farnsworth hydrocarbon field, Anadarko basin, Texas
Role: Principal advisor
Duration: June, 2015 to present

Name: Sarah Smith
Program: Master's of Science degree in Geological Sciences/ Ph.D in Geological Sciences beginning August 22, 2016
Project title: Determination of metal content in aqueous fluids from solid solution concentrations in hydrothermal minerals
Role: Principal advisor
Duration: October, 2014 to present

Name: Stuart Kenderes
Program: Master's of Science degree in Geological Sciences
Project title: Origin of fluorite and rare Earth element mineralization in the Illinois-Kentucky district
Role: Principal advisor
Duration: August, 2014 to present

Name: Bulbul Ahmmed
Program: Master's of Science degree in Geological Sciences
Project title: Numerical modeling of CO₂-water-rock interactions in the Farnsworth, Texas hydrocarbon unit, USA
Role: Principal advisor
Duration: August, 2013 to May, 2015

Name: Joshua Field
Program: Ph.D. in Geological Sciences
Role: Principal advisor
Duration: August, 2013 to present

Name: Abdelsalam Hassan
Program: Master's of Science degree in Geological Sciences
Project title: Geochemistry of fluid inclusions from the Vazante zinc deposit, Minas Gerais, Brazil

Role: Principal advisor
Duration: January, 2012 to July, 2014

Name: Chris Burrows
Program: Master's of Science degree in Geological Sciences
Project title: Hydrology of the Forest City basin, mid-continent, USA: implications for CO₂ sequestration in the St. Peter Sandstone
Role: Principal advisor
Duration: August, 2010 to December, 2012

Name: Ajit Joshi
Program: Master's of Science and Ph.D. degree in Geological Sciences
Project title: Evaluation of the origin and hydrocarbon transport capabilities of solitary waves in fault conduits with visco-elastic rheologies
Role: Principal advisor
Duration: August, 2009 to December, 2015

Name: Michael Pelch
Program: Master's of Science degree in Geological Sciences
Project title: Geochemistry of Mississippi Valley-type mineralization in the Illinois-Kentucky fluorspar district
Role: Principal advisor
Duration: August, 2009 to August, 2011

Name: Mark Leatherman
Program: Master's of Science degree in Geological Sciences
Project title: Time-dependent hydrothermal convection within the Great Basin, Nevada
Role: Principal advisor
Duration: August, 2008 to December, 2010

Name: Zachary Wenz
Program: Ph.D. in Geological Sciences
Project title: Origin of sediment-hosted zinc-lead deposits in the Ozark Plateau
Role: Principal advisor
Duration: August, 2007 to August, 2011

Name: Sara Harkins
Program: Master's of Science degree in Geological Sciences
Project title: Lead isotope constraints on the origin of non-sulfide zinc and sulfide zinc-lead deposits in the Flinders Ranges, South Australia
Role: Principal advisor
Duration: January, 2005 to May, 2007

Name: Jamie Cachine
Program: Master's of Science degree in Geological Sciences
Project title: Numerical modeling of Mississippi Valley-type mineralization in the Tri-State Zn-Pb district
Role: Principal advisor
Duration: September, 2004 to August, 2005
Duration: August, 2003 to May, 2004

Undergraduate Students Supervised

Name: Cale Diehl
Program: Undergraduate research project
Project title: Composition of fluid inclusions in subeconomic Zn-Pb deposits in the Vazante-Unai district, Brazil
Role: Principal advisor
Duration: August, 2014 to present

Name: Emma Rosenow
Program: Undergraduate research project
Project title: Hydrogeology of the Beowawe, Nevada geothermal field
Role: Principal advisor
Duration: June, 2014 to December, 2014

Name: Derek Prokopf
Program: Senior thesis research project
Project title: Geochemistry of fluid inclusions in the Morro Agudo Pb-Zn deposit, Minas Gerais, Brazil
Role: Principal advisor
Duration: January, 2012 to December, 2012

Name: Rachel Duckworth
Program: Senior thesis research project
Project title: Hydraulic characteristics and carbon sequestration potential of the Forest City Basin in Missouri, Kansas, Nebraska, and Iowa
Role: Principal advisor
Duration: January, 2012 to May, 2012

Name: Chris Burrows
Program: Undergraduate capstone research project
Project title: Geochemistry of surface waters in the Central Missouri mining district
Role: Principal advisor
Duration: January, 2009 to May, 2009

Name: Brandon Harmon
Program: Undergraduate research project
Project title: Petrography of zinc mineralization in the Vazante-Unai trend, Brazil
Role: Principal advisor
Duration: January, 2008 to May, 2008

Name: Ryan Verbanaz
Program: Undergraduate research project
Project title: Preparation of synthetic sulfate-bearing fluid inclusions in halite for Raman microprobe calibration
Role: Principal advisor
Duration: August, 2007 to May, 2008

Name: Joseph Lutes
Program: Undergraduate research project
Project title: Scanning electron microscopy of fluorite and sulfide mineralization from the Illinois-Kentucky Fluorspar district
Role: Principal advisor
Duration: August, 2007 to December, 2007

Name: Jessica Haynes
Program: Undergraduate research project
Project title: Preparation of synthetic sulfate-bearing fluid inclusions in halite for Raman microprobe calibration
Role: Principal advisor
Duration: January, 2007 to May, 2007

Name: Stephanie Labeledz
Program: Honors College Learning-by-Contract for GEOL 1100 (Principles of Geology)
Project title: Topics in physical geology
Role: Principal advisor
Duration: August, 2006 to December, 2006

Name: Rafael Rubo
Program: Undergraduate research project

Project title: Fluid inclusion microthermometry of Mississippi Valley-type mineralization in the Illinois-Kentucky Fluorspar district
Role: Principal advisor
Duration: August, 2006 to December, 2006

Name: Gregory Forbis
Program: Undergraduate research project
Project title: Fluid inclusion microthermometry of Mississippi Valley-type mineralization in the Illinois-Kentucky Fluorspar district
Role: Principal advisor
Duration: January, 2006 to May, 2006

Name: Talita Lammoglia
Program: Undergraduate directed study
Project title: Groundwater modeling of the McBaine Bottoms fluvial aquifer
Role: Principal advisor
Duration: August, 2005 to December, 2005

Name: Nicholas McClean
Program: Undergraduate research project
Project title: Fluid inclusion analysis of the Tri-State Zn-Pb district
Role: Principal advisor
Duration: August, 2003 to July, 2004

Name: Brenda Saville
Program: Undergraduate research project
Project title: Microthermometric analysis of fluid inclusions in the Upper Mississippi Valley Zn-Pb district
Role: Principal advisor
Duration: August, 2002 to May, 2003

Name: Jana Pedersen
Program: Undergraduate research project
Project title: Microthermometric analysis of fluid inclusions in the Picher Mississippi Valley-type Zn-Pb deposit
Role: Principal advisor
Duration: August, 2001 to May, 2002

Name: Tye Numelin
Program: Undergraduate research project
Project title: Microthermometric analysis of fluid inclusions in the Southeast Missouri Pb-Zn-Cu district
Role: Principal advisor
Duration: January, 2000 to July, 2001

Courses Taught While at the University of Missouri

Title: Groundwater Hydrology (previously Hydrogeology)
Course number: GEOL 4100/7100 (upper level undergraduate; lower level graduate)
Credit hours: 3
Description: This course examines the origin, flow, and recovery of water within shallow levels of the Earth's crust. Major topics include the relationship between surface and ground water, theory of groundwater flow, well hydraulics, the geology of groundwater, and solute transport.
Semesters taught: Spring, 2005; Spring, 2006; Fall, 2007; Fall, 2008; Fall, 2009; Fall, 2010; Fall, 2011; Fall, 2012; Fall, 2013; Fall, 2014

Title: Groundwater Modeling
Course number: GEOL 4130/7130 (upper level undergraduate; lower level graduate)
Credit hours: 3
Description: The focus of this course is on the principles and use of numerical solution methods and computer

programs to simulate the flow of fluids and transport of dissolved mass in the subsurface. Emphasis will be placed on learning and applying the GMS (Groundwater Modeling System™) software, a leading groundwater modeling package that is currently among the most widely used in the world. The course is designed to prepare students to solve a variety of commonly encountered problems in groundwater hydrology, such as the velocity of fluids in the subsurface, the response of the water table due to pumping, the distribution of solute concentrations originating from a contaminant source.

Semesters taught: Fall, 2005; Fall, 2006; Spring, 2008; Spring, 2010; Spring, 2012; Spring, 2014

Title: Hydrogeologic Processes (previously Advanced Hydrogeology)

Course number: GEOL 8240 (upper level graduate)

Credit hours: 3

Description: This course begins by examining the theory that governs how groundwater flows and transports solute and heat, and how groundwater interacts mechanically and geochemically with porous media and other fluids in the subsurface. The course then examines the behavior of groundwater in several broad categories of geologic processes, such as sedimentary diagenesis, hydrothermal mineralization, groundwater-magma interactions, hydrocarbon migration, earthquake generation, and metamorphism.

Semesters taught: Fall, 2004; Spring, 2007; Spring, 2009; Spring, 2011; Spring, 2013

Title: Mineral and Energy Resources of the Earth

Course number: GEOL 2600 (lower level undergraduate)

Credit hours: 3

Description: This course examines the geology of Earth's major mineral and energy resources--their origin, distribution, and characteristics--and societal implications of their use and abundance.

Semesters taught: Spring, 2010; Spring, 2013

Title: Mineralogy

Course number: GEOL 3250

Credit hours: 5

Description: Introduction to crystallography, crystal chemistry, and crystal structures. Systematic study of mineral groups—includes identification of minerals by physical, chemical, and optical properties.

Semesters taught: Fall, 2014

Title: Principles of Geology

Course number: GEOL 1100 (lower level undergraduate)

Credit hours: 4

Description: An introduction to the fundamental geologic processes that shape the Earth, and to the materials from which the Earth is comprised.

Semesters taught: Fall, 2005; Fall, 2006; Fall, 2008, Spring, 2012; Spring, 2014

Title: Themes in Geology—Geology and Genesis

Course number: GEOL 1400 (lower level undergraduate)

Credit hours: 1

Description: This course will investigate the geologic basis for the age of the Earth and how the findings of an old Earth fit into the relationship between science and religion, particularly Christianity, in contemporary American society. Specifically, the course will seek to address the questions: (1) How has the mainstream geologic community arrived at the conclusion that the Earth is old (~4.6 billion years)? (2) How has the Christian community responded to this assertion and why? The course will thus be a mixture of science, theology, philosophy, and history that will attempt to be introductory enough so as not to require any prerequisite university-level courses, but to have enough depth to be meaningful and useful.

Semesters taught: Spring, 2011

Title: Themes in Geology—Mineral and Energy Resources

Course number: GEOL 1400 (lower level undergraduate)

Credit hours: 1

Description: This course examines the geology of some of Earth's major mineral and energy resources--their origin, distribution, and characteristics--and societal implications of their use and abundance.

Semesters taught: Spring, 2015

Courses Taught While at the University of Iowa

Title: Earth History and Resources

Course number: 012:003 (lower level undergraduate)

Credit hours: 3

Description: An introduction to the fundamental geologic processes that shape the Earth, and to the materials from which the Earth is comprised.

Semesters Taught: Spring, 2002; Fall, 2002; Spring, 2004

Title: Elements of Geochemistry

Course number: 012:149 (upper level undergraduate)

Credit hours: 3

Description: This course introduces the application of chemical principles to the solution of geologic problems. Emphasis is placed on the use of geochemistry to make predictions about the outcome of Earth and environmental processes. Major topics of study include chemical equilibrium, elementary thermodynamics and kinetics, chemical differentiation of the Earth, carbonate and silicate stability relationships, aqueous speciation modeling, chemical weathering, adsorption, trace element behavior, oxidation-reduction reactions, and characterization of surface and ground waters.

Semesters Taught: Spring, 2001; Spring, 2002; Spring, 2003

Title: Field Methods

Course number: 012:093 (intermediate to upper level undergraduate)

Credit hours: 4 (team-taught 50%)

Description: Students are introduced to basic principles and techniques of field geology including : learning and constructing stratigraphic sections, measuring planar structures, identifying geologic map units and contacts, making geologic maps complete with legend and cross sections. The course will be taught over a two-week period in the Black Hills of South Dakota and Big Horn Mountains of northern Wyoming.

Semesters Taught: Summer, 2003

Title: Geochemical Thermodynamics and Kinetics

Course number: 012:254 (graduate)

Credit hours: 3 (team-taught 67%)

Description: This course examines the energy transformations that govern the outcome of geochemical reactions (thermodynamics) and the molecular interactions that govern the rate at which they occur (kinetics). A central focus is on the concept of equilibrium versus non-equilibrium and the behavior of reactions under these two different conditions. Applications are made to both high temperature igneous and metamorphic systems and low temperature surface and shallow-Earth systems.

Semesters Taught: Fall, 2000

Title: Geophysical Subsurface Analysis

Course number: 012:183 (upper level undergraduate; lower level graduate)

Credit hours: 2

Description: Analysis, interpretation, and visualization of geophysical and geologic data. Implementation of current industry and academic research software packages. Applications to petroleum and mineral resource exploration, and to environmental contamination problems.

Semesters Taught: Spring, 2000; Spring, 2001

Title: Natural Water Geochemistry

Course number: 012:150 (upper level undergraduate)

Credit hours: 3

Description: Chemical processes and reactions controlling natural water chemistry; solubility equilibria, thermodynamics of aqueous solution, properties of ground and surface waters, spatial and temporal evolution of natural waters in different geologic terrains, use of geochemical tracers; computational work in analytical problems, speciation and mass-transfer models, rock-water interactions.

Semesters Taught: Spring, 2000

Title: Ore Deposits

Course number: 012:182 (upper level undergraduate; lower level graduate)

Credit hours: 3

Description: This course presents an introduction to the geology of ore deposits and the processes that form them. Topics include characteristics and global distribution of base and precious metal deposits; source, mode of transport, and depositional mechanisms of ore constituents; ore microscopy; fluid inclusions; exploration methods; and case studies of individual deposits and districts.

Semesters Taught: Fall, 2001

Title: Remote Sensing

Course number: 012:110 (upper level undergraduate)

Credit hours: 3

Description: An introduction to remote sensing techniques applied to the earth and environmental sciences: Acquisition, processing, and interpretation of various types of electromagnetic data obtained from aircraft and satellites from the surface of the Earth.

Semesters Taught: Fall, 2002; Fall, 2003

Title: Spring Field Trip

Course number: 012:116 (intermediate to upper level undergraduate)

Credit hours: 3

Description: This course will focus on the stratigraphy, structure, mineral deposits, and igneous rocks of the St. Francois Mountains in southeastern Missouri, and the Ouachita Mountains in western Arkansas. The course will meet once per week for 1.5 hours until March 12. The field trip will occur over Spring Break, March 14-22.

Semesters Taught: Spring, 2003

SERVICE

Department Service

Type: Chair of search committee for faculty position in low-temperature geochemistry

Duration: August, 2011 to May, 2012

Type: Member of Faculty Salary Committee

Duration: August, 2010 to May, 2013

Type: Co-organizer of Williamson Colloquium

Duration: August, 2005 to present

Type: Graduate Admissions Committee

Duration: August, 2004 to August, 2009

University Service

Type: Arts & Sciences Undergraduate Scholarship Committee

Duration: August, 2012 to May, 2016

Type: Research Council

Duration: August, 2009 to May, 2012

External Service

Type: Chair of organizing committee and co-convener of the Pan-American Current Research on Fluid Inclusions XIII conference, Columbia, Missouri

Date: May 23-28, 2016

Type: Co-convenor of topical session, “Mississippi Valley–type and other mineral deposits of the Midwest USA” at the North-Central Geological Society of America meeting, Champaign, Illinois
Date: April 18, 2016

Type: Co-convenor of topical session, “Metals in ore fluids: sources, concentrations, modes of transport, and precipitation” at the Geological Society of America annual meeting, Baltimore, Maryland
Date: November 2, 2015

Type: Editor for the journal, *Hydrogeology Journal*
Duration: April 15, 2015 to present

Type: Working group co-leader for numerical simulation for the Southwest Partnership on CO₂ Sequestration
Duration: June, 2013 to present

Type: Co-convenor of topical session, “Sediment-hosted base metal deposits” at the Geological Society of America annual meeting, Denver, Colorado
Date: October 28, 2013

Type: Co-convenor of topical session, “Ore deposits of the central U.S.: origin, mining, and environmental remediation” at the North Central Geological Society of America meeting, Branson, Missouri
Date: April 12, 2010

Type: Associate editor for the journal, *Geofluids*
Duration: July, 2009 to June, 2015

Type: Associate editor for the journal, *Hydrogeology Journal*
Duration: January 1, 2010 to December 31, 2013

Type: Co-editor of thematic volume in *Geofluids* based on Geological Society of America theme session entitled, “Numerical modeling of hydrothermal fluids.”
Duration: January, 2008 to April 2009

Type: Co-convenor of topical session, “Numerical modeling of hydrothermal fluids” at the Geological Society of America annual meeting, Denver, Colorado
Date: October 29, 2007

Type: Co-convenor of topical session, “Groundwater flow and transport processes in carbonate aquifers” at the South Central-North Central Geological Society of America meeting, Lawrence, Kansas
Date: April 12, 2007

PROFESSIONAL MEMBERSHIPS

American Geophysical Union
Geological Society of America
Society of Economic Geologists
International Association of Hydrogeologists