BRIAN W. STEWART

Department of Geology & Environmental Science
University of Pittsburgh
Pittsburgh, PA 15260
bstewart@pitt.edu

EDUCATION

Ph.D., Geochemistry (1990)	University of California at Los Angeles *D. J. DePaolo, advisor*
B.S., Geology (1983)	Brown University

PROFESSIONAL APPOINTMENTS

2002 –	Associate Professor of Geology & Environmental Science, University of Pittsburgh
2010 – 2011	Oak Ridge Institute for Science and Education (ORISE) Faculty Research Associate
2005 – 2008	Department Chair, Geology & Planetary Science, University of Pittsburgh
2002 – 2003	Visiting Scientist, Earth & Atmospheric Sciences, Cornell University
1995 – 2001	Assistant Professor of Geology & Planetary Science, University of Pittsburgh
1994 – 1995	Research Assistant Professor of Geology & Planetary Science, University of Pittsburgh
1994	Postdoctoral Research Fellow, University of California, Riverside *(R.C. Graham, Department of Soil & Environmental Science, Sponsor)*
1992 – 1994	Associate Scientist and Visiting Associate, California Institute of Technology
1990 – 1992	Postdoctoral Research Fellow, California Institute of Technology *(G.J. Wasserburg, Department of Geological & Planetary Sciences, Sponsor)*

RESEARCH

Application of radiogenic isotopes as a geochronological tool and as tracers for natural physical and chemical processes to understand geochemical processes in earth and environmental systems. Current research is focused on geochemical processes at or near the Earth's surface; and environmental and economic geochemistry.

PUBLICATIONS

Peer-Reviewed Articles (superscript: advised or co-advised undergraduate/graduate student* or postdoc†)

IN PRESS/PUBLISHED

Stewart, B.W. and Capo, R.C. (2022) Chapter 10: Metal isotope signatures as tracers for unconventional oil and gas fluids. In *Environmental Impacts from the Development of Unconventional Oil and Gas Reserves* (eds. J. Stolz, D. Bain, M. Griffin), Cambridge University Press, pp. 246-271; doi:10.1017/9781108774178.013.

Matecha, R.M.*, Xiong, W., Heck, W.F.*, **Stewart, B.W.**, Capo, R.C., Hakala, J.A. (2022) Experimental investigation of barium sources and fluid-rock interaction in unconventional Marcellus Shale wells using Ba isotopes. *Energy & Fuels 36*, 4470-4478.

Matecha, R.M.*, Capo, R.C., **Stewart, B.W.**, Thompson, R.L., Hakala, J.A. (2021) A single column separation method for barium isotope analysis of geologic and hydrologic materials with complex matrices. *Geochemical Transactions 22:4,* https://doi.org/10.1186/s12932-021-00077-z.

Gardiner, J.B.*, Capo, R.C., Newell, D.L., **Stewart, B.W.**, Phan, T.T., Keating, E.H., Guthrie, G.D., Hakala, J.A. (2021) Tracking natural CO_2 migration through a sandstone aquifer using Sr, U and C isotopes: Chimayó, New Mexico, USA. *International Journal of Greenhouse Gas Control 104,* 103209.

Hedin, B.C.*, Hedin, R.S., Capo, R.C., **Stewart, B.W.** (2020) Critical metal recovery potential of Appalachian acid mine drainage treatment solids. *International Journal of Coal Geology 231*, 103610.

Tieman, Z.G.*, **Stewart, B.W.**, Capo, R.C., Phan, T.T.†, Lopano, C.L., Hakala, J.A. (2020) Barium isotopes track the source of dissolved solids in produced water from the unconventional Marcellus Shale gas play. *Environmental Science & Technology 54,* 4275-4285.

Wallrich, I.L.R.*, **Stewart, B.W.**, Capo, R.C., Hedin, B.C.*, Phan, T.T.† (2020) Neodymium isotopes track sources of rare earth elements in acidic mine waters. *Geochimica et Cosmochimica Acta 269*, 465-483.

Mackey, J.E.*, **Stewart, B.W.** (2019) Evidence of anoxia in Late Cambrian Ocean: Paired $\delta^{13}C$ and trace element chemostratigraphy of upper Conasauga Group, Central Appalachian Basin. *Palaeogeography, Palaeoclimatology, Palaeoecology 528,* 160-174.

Hedin, B.C.*, Capo, R.C., **Stewart, B.W.**, Hedin, R.S., Lopano, C.L., Stuckman, M.Y. (2019) The evaluation of critical rare earth element (REE) enriched treatment solids from coal mine drainage passive treatment systems. *International Journal of Coal Geology 208,* 54-64.

Phan, T.T.†, Gardiner, J.B.*, Capo, R.C., **Stewart, B.W.** (2018) Geochemical and multi-isotopic ($^{87}Sr/^{86}Sr$, $^{143}Nd/^{144}Nd$, $^{238}U/^{235}U$) perspectives of sediment sources, depositional conditions, and diagenesis of the Marcellus Shale, Appalachian Basin, USA. *Geochimica et Cosmochimica Acta 222,* 187-211.

Pfister, S.*, Capo, R.C., **Stewart, B.W.**, Macpherson, G.L., Phan, T.T.†, Gardiner, J.B.*, Diehl, J.R., Lopano, C.L., Hakala, J.A. (2017) Geochemical and lithium isotope tracking of dissolved solid sources in Permian Basin carbonate reservoir and overlying aquifer waters at an enhanced oil recovery site, northwest Texas, USA. *Applied Geochemistry 87,* 122-135.

Stewart, B.W., Capo, R.C., Hedin, B.C.*, Hedin, R.S. (2017) Rare earth element resources in coal mine drainage and treatment precipitates in the Appalachian Basin, USA. *International Journal of Coal Geology 169*, 28-39.

Wolfe, A.L.*, **Stewart, B.W.**, Capo, R.C., Dzombak, D.A., Liu, R., Gordon, G., Anbar, A.D. (2016) Iron isotope investigation of hydrothermal and sedimentary pyrite and their aqueous dissolution products. *Chemical Geology 427,* 73-82.

Phan, T.T.†, Capo, R.C., **Stewart, B.W.**, Macpherson, G.L., Rowan, E.L., Hammack R.W. (2016) Factors controlling Li concentration and isotopic composition in formation waters and host rocks of Marcellus Shale, Appalachian Basin. *Chemical Geology 420,* 162-179.

Macpherson, G.L., Phan, T.T.†, **Stewart, B.W.** (2015) Direct determination (without chromatographic separation) of lithium isotopes in saline fluids using MC-ICPMS: establishing limits on water chemistry. *Journal of Analytical Atomic Spectroscopy 30,* 1673-1678.

Phan, T.T.†, Capo, R.C., **Stewart, B.W.**, Graney, J.R., Johnson, J.D., Sharma, S., Toro, J. (2015) Trace metal distribution and mobility in drill cuttings and produced waters from Marcellus shale gas extraction: uranium, arsenic, barium. *Applied Geochemistry 60,* 89-103.

Stewart, B.W., Chapman, E.C.*, Capo, R.C., Johnson, J., Graney, J., Kirby, C.S., Schroeder, K.T. (2015) Origin of brines, salts and carbonate from shales of the Marcellus Formation: Evidence from geochemical and Sr isotope study of sequentially extracted fluids. *Applied Geochemistry 60,* 78-88.

Johnson, J.D., Graney, J.R., Capo, R.C., **Stewart, B.W.** (2015) Identification and quantification of regional brine and road salt sources in watersheds along the New York/Pennsylvania border, U.S.A. *Applied Geochemistry 60,* 37-50.

Newell, D.L., Perkins, G., Larson, T., Pugh, J.D., **Stewart, B.W.**, Capo, R.C., and Trautz, R. (2014) Tracing CO_2 leakage into groundwater using carbon and strontium isotopes during a controlled CO_2 release field test. *International Journal of Greenhouse Gas Control 29,* 200-208.

Kolesar Kohl, C.A.*, Capo, R.C., **Stewart, B.W**., Wall, A.J.†, Schroeder, K.T., Hammack, R.W., Guthrie, G.D. (2014) Strontium isotopes test long-term zonal isolation of injected and Marcellus Formation water after hydraulic fracturing. *Environmental Science & Technology 48,* 9867-9873.

Macpherson, G.L., Capo, R.C., **Stewart, B.W**., Phan, T.T.†, Schroeder, K.T., Hammack, R.W. (2014) Temperature-dependent Li isotope ratios in Appalachian Plateau and Gulf Coast Sedimentary Basin saline water. *Geofluids 14,* 419-429.

Capo, R.C., **Stewart, B.W**., Rowan, E.L., Kolesar, C.A.*, Wall, A.J., Chapman, E.C.*, Hammack, R.W., Schroeder, K.T. (2014) The strontium isotopic evolution of Marcellus Formation produced waters, southwestern Pennsylvania. *International Journal of Coal Geology 126,* 57-63.

Soeder, D.J., Sharma, S., Pekney, N., Hopkinson, L., Dilmore, R., Kutchko, B.G., **Stewart, B.W**., Carter, C., Hakala, J.A., Capo, R.C. (2014) An approach for assessing engineering risk from shale gas wells in the United States. *International Journal of Coal Geology 126,* 4-19.

Wall, A.J.†, Capo, R.C., **Stewart, B.W.**, Phan, T.T.†, Jain, J.C., Hakala, J.A., Guthrie, G.D. (2013) High throughput method for Sr extraction from variable matrix waters and $^{87}Sr/^{86}Sr$ isotope analysis by MC-ICP-MS. *Journal of Analytical Atomic Spectrometry 28,* 1338-1344.

Brubaker, T.M.*, **Stewart, B.W.**, Capo, R.C., Schroeder, K.T., Chapman, E.C.*, Spivak-Birndorf, L.J.*, Vesper, D.J., Cardone, C.R., Rohar, P.C. (2013) Coal fly ash interaction with environmental fluids: Geochemical and strontium isotope results from combined column and batch leaching experiments. *Applied Geochemistry 32*, 184-194.

Chapman, E.C.*, Capo, R.C., **Stewart, B.W.**, Hedin, R.S., Weaver, T.J., Edenborn, H.M. (2013) Strontium isotope quantification of siderite, brine, and acid mine drainage contributions to abandoned gas well discharges in the Appalachian Plateau. *Applied Geochemistry 31*, 109-118.

Amundson, R., Dietrich, W., Bellugi, D., Ewing, S., Nishiizumi, K., Chong, G., Owen, J., Finkel, R., Heimsath, A., **Stewart, B.**, and Caffee, M. (2012) Geomorphologic evidence for the late Pliocene onset of hyperaridity in the Atacama Desert. *Geological Society of America Bulletin 124,* 1048-1070.

Schatzel, S.J.* and **Stewart, B.W.** (2012) A provenance study of mineral matter in coal from Appalachian Basin coal mining regions and implications regarding the respirable health of underground coal workers: A geochemical and Nd isotope investigation. *International Journal of Coal Geology 94*, 123-136.

Chapman, E.C.*, Capo, R.C., **Stewart, B.W**., Kirby, C.S., Hammack, R.W., Schroeder, K.T., Edenborn, H.M. (2012) Geochemical and strontium isotope characterization of produced waters from Marcellus Shale natural gas extraction. *Environmental Science & Technology 46*, 3545-3553.

Spivak-Birndorf, L.J.*, **Stewart, B.W**., Capo, R.C., Chapman, E.C.*, Schroeder, K.T., Brubaker, T.M.* (2012) Strontium isotope study of coal utilization byproducts interacting with environmental waters. *Journal of Environmental Quality 41,* 144-154.

Hamel, B.L.*, **Stewart, B.W.** and Kim, A.G.* (2010) Tracing the interaction of acid mine drainage with coal utilization byproducts in a grouted mine: Strontium isotope study of the inactive Omega Coal Mine, West Virginia (USA). *Applied Geochemistry 25,* 212-223.

Liu, R., Wolfe, A.L.*, Dzombak, D.A., Horwitz, C.P., **Stewart, B.W.**, and Capo, R.C. (2009) Controlled electrochemical dissolution of hydrothermal and sedimentary pyrite. *Applied Geochemistry 24*, 836-842.

Cole, R.B. and **Stewart, B.W.** (2009) Continental margin volcanism at sites of spreading ridge subduction: Examples from southern Alaska and western California. *Tectonophysics 464*, 118-136.

Liu, R., Wolfe, A.L.*, Dzombak, D.A., Horwitz, C.P., **Stewart, B.W.**, and Capo, R.C. (2008) Electrochemical study of hydrothermal and sedimentary pyrite dissolution. *Applied Geochemistry 23*, 2724-2734.

Liu, R. Wolfe, A.L.*, Dzombak, D.A., **Stewart, B.W.**, and Capo, R.C. (2008). Comparison of dissolution under oxic acid drainage conditions for eight sedimentary and hydrothermal pyrite samples. *Environmental Geology 56*, 171-182.

Ewing, S., Yang, W., DePaolo, D.J., Michalski, G., Kendall, C., **Stewart, B.W.**, Thiemens, M. and Amundson, R. (2008) Non-biological fractionation of stable Ca isotopes in soils of the Atacama Desert, Chile. *Geochimica et Cosmochimica Acta 72*, 1096-1110.

Wolfe, A.L.*, Liu, R., **Stewart, B.W.**, Capo, R.C. and Dzombak, D.A. (2007) A method for generating uniform size-segregated pyrite particle fractions, *Geochemical Transactions 8*:9 doi:10.1186/1467-4866-8-9; 8p.

Watanabe, Y., **Stewart, B.W.** and Ohmoto, H. (2004) Organic- and carbonate-rich soil formation ~2.6 billion years ago at Schagen, East Transvaal district, South Africa. *Geochimica et Cosmochimica Acta 68*, 2129-2151.

Doran, P.T., Clifford, S.M., Forman, S.L., Nyquist, L., Papanastassiou, D.A., **Stewart B.W.**, Sturchio, N.C., Swindle, T.D., Cerling, T., Kargel, J., McDonald, G., Nishiizumi, K., Poreda, R., Rice, J. & Tanaka, K. (2004) Mars chronology: assessing techniques for quantifying surface processes. *Earth Science Reviews 67*, 313-337.

Schatzel, S.J.* and **Stewart, B.W.** (2003) Rare earth element sources and modification in the Lower Kittanning coal bed, Pennsylvania: implications for the origin of coal mineral matter and rare earth element exposure in underground mines. *International Journal of Coal Geology 54*, 223-251.

Pretti, V.A.* and **Stewart, B.W.** (2002) Solute sources and chemical weathering in the Owens Lake watershed, eastern California. *Water Resources Research 38,* 2.1-2.18, doi:10.1029/2001WR000370.

Stewart, B.W., Capo, R.C., and Chadwick, O.A. (2001) Effects of rainfall on weathering rate, base cation provenance, and Sr isotope composition of Hawaiian soils. *Geochimica et Cosmochimica Acta 65*, 1087-1099.

Whipkey, C.E.*, Capo, R.C., Chadwick, O.A., and **Stewart, B.W.** (2000) The importance of sea spray to the cation budget of a coastal Hawaiian soil: a strontium isotope approach. *Chemical Geology 168*, 37-48.

Stewart, B.W., Capo, R.C. and Chadwick, O.A. (1998) Quantitative strontium isotope models for weathering, pedogenesis and biogeochemical cycling. *Geoderma 82*, 173-195.

Capo, R.C., **Stewart, B.W.** and Chadwick, O.A. (1998) Strontium isotopes as a tracer of earth surface processes: Theory and methods. *Geoderma 82*, 197-225.

Stewart, B.W., Papanastassiou, D.A. and Wasserburg, G.J. (1996) Sm-Nd systematics of a silicate inclusion from the Caddo IAB iron meteorite. *Earth and Planetary Science Letters 143*, 1-12.

Stewart, B.W. and DePaolo, D.J. (1996) Isotopic studies of processes in mafic magma chambers: III. The Muskox intrusion, Northwest Territories, Canada. *In* S.R. Hart and A.R. Basu, eds., *Earth Processes: Reading the Isotopic Code. Geophysical Monograph* 95. New York, American Geophysical Union, 277-292.

Stewart, B.W., Papanastassiou, D.A. and Wasserburg, G.J. (1994) Sm-Nd chronology and petrogenesis of mesosiderites. *Geochimica et Cosmochimica Acta 58*, 3487-3509.

Stewart, B.W. and DePaolo, D.J. (1992) Diffusive isotopic contamination of mafic magma by coexisting silicic liquid in the Muskox intrusion. *Science 255*, 708-711.

Stewart, B.W. and DePaolo, D.J. (1990) Isotopic studies of processes in mafic magma chambers: II. The Skaergaard intrusion, East Greenland. *Contributions to Mineralogy and Petrology 104*, 125-141.

Non-Peer Reviewed Reports, Proceedings, or Prefaces

Wall, A.J.†, Capo, R.C., **Stewart, B.W.**, Phan, T.T.†, Jain, J.C., Hakala, J.A., Guthrie, G.D. (2016) High throughput method for strontium isotope analysis by multi-collector-inductively coupled plasma-mass spectrometer. *NETL-TRS-12-2016; NETL Technical Report Series*, U.S. Department of Energy, National Energy Technology Laboratory: Pittsburgh, PA, 69 p.

Stewart, B.W., Capo, R.C., Kirby, C.S. (2015) Geochemistry of unconventional shale gas from formation to extraction: Petrogenesis, hydraulic fracturing, and environmental impacts (Preface). *Applied Geochemistry 60,* 1-2.

Keating, E.H., Newell, D.L., **Stewart, B.W.**, Capo, R.C., Pawar, R. (2014) Further insights into interconnections between the shallow and deep systems from a natural CO_2 reservoir near Springerville, Arizona, U.S.A. *Energy Procedia 63*, 3195-3201.

Hammack, R.W., Harbert, W., Sharma, S., **Stewart, B.W.**, Capo, R.C., Wall, A.J., Wells, A., Diehl, R., Blauschild, D., Sams, J., Veloski, G. (2014) An Evaluation of Fracture Growth and Gas/Fluid Migration as Horizontal Marcellus Shale Gas Wells are Hydraulically Fractured in Greene County, Pennsylvania. *NETL-TRS-3-2014; EPAct Technical Report Series;* U.S. Department of Energy, National Energy Technology Laboratory: Pittsburgh, PA, 76 p.

Keating, E., Viswanathan, H., Fessenden, J., Carey, J., Guthrie, G., Hakala, J., Capo, R., **Stewart, B.**, and Gardiner, J.* (2011) The challenge of predicting groundwater quality impacts in CO_2 leakage scenarios: Results from field, laboratory, and modeling studies at a natural analog site in New Mexico, USA. *Energy Procedia 4*, 3239-3245.

Doran, P.T., Clifford, S.M., Forman, S.L., Nyquist, L., Papanastassiou, D.A., **Stewart, B.W.**, Sturchio, N.C., Swindle, T.D., eds. (2000) Workshop Report: Assessing Chronometric techniques for Quantifying Surficial Processes on Mars. Report to the JPL Mars Program Office.

EXTERNAL FUNDING

(All amounts shown are University of Pittsburgh total unless otherwise indicated)

Optimizing rare earth element capture during treatment of acid mine drainage: Validation of geochemical modeling through bench-scale experiments and proof-of-concept field studies
OSMRE Applied Science Program $200,000
2022-2024
PI: B.W. Stewart,
Co-I: R.C. Capo (University of Pittsburgh); C.A. Cravotta III (USGS); B.C. Hedin (Hedin Environmental)

Quantifying the geochemical evolution of water discharged from a flooded mine pool to optimize mine drainage treatment strategies
OSMRE- Mine Drainage Technology Initiative (MDTI) $200,000
2020-2022
PI: R.C. Capo (University of Pittsburgh)
Co-I: B.W. Stewart, C.A. Cravotta III (USGS); D.J. Vesper (WVU)

Novel geochemical signal methodologies (T008)
DOE-National Energy Technology Laboratory/Leidos $200,000
2019-2023
PI: R.C. Capo (University of Pittsburgh)
Co-I: B.W. Stewart

Geochemical Testing & Analysis of Reactive Flow Tests and Modeling of Established Isotope Tracers in Unconventional Oil and Gas (UOG) Basins (T010)
DOE-National Energy Technology Laboratory/Leidos $164,000
2019-2022
PI: B.W. Stewart
Co-I: R.C. Capo (University of Pittsburgh)

Novel geochemical signal methodologies (T220)
DOE-National Energy Technology Laboratory/AECOM $37,131
2017-2018
PI: B.W. Stewart
Co-I: R.C. Capo (University of Pittsburgh)

Chemical analysis of reactive flow tests (T209)
DOE-National Energy Technology Laboratory/AECOM $23,000
2017-2018
PI: B.W. Stewart
Co-I: R.C. Capo (University of Pittsburgh)

A chemostratigraphic study of regional and global controls on deposition and preservation of Late Cambrian shales of the Conasauga Formation
ACS-PRF: Petroleum Research Fund *$110,000*
2016-2018
PI: B.W. Stewart (no Co-I)

Natural geochemical tracers in groundwater
DOE-National Energy Technology Laboratory/URS/AECOM $54,640
2016-2018
PI: R.C. Capo (University of Pittsburgh)
Co-I: B.W. Stewart

Comprehensive groundwater field testing
DOE-National Energy Technology Laboratory/URS/AECOM $7,020
2017-2018
PI: B.W. Stewart
Co-I: R.C. Capo (University of Pittsburgh)

Natural isotopic tracers in groundwater
DOE-National Energy Technology Laboratory/URS/AECOM $35,000
2016-2017
PI: B.W. Stewart
Co-I: R.C. Capo (University of Pittsburgh)

Fluid and solid isotope characterization at the MSEEL Site (WV)
DOE-National Energy Technology Laboratory/URS $10,500
2016
PI: B.W. Stewart
Co-I: R.C. Capo (University of Pittsburgh)

Geological sample processing and analysis
DOE-National Energy Technology Laboratory/URS $14,850
2015
PI: B.W. Stewart (no Co-I)

Isotopic and elemental composition to evaluate potential mobility of contaminants As, U
DOE-National Energy Technology Laboratory/URS $108,200
2013-2014
PI: B.W. Stewart (no Co-I)

Natural isotope tracers - CO_2 sequestration
DOE-National Energy Technology Laboratory/URS $175,000
2013-2014
PI: R.C. Capo (University of Pittsburgh)
Co-I: B.W. Stewart

Evaluate isotopic composition of geologic end-members and fluid produced water samples
DOE-National Energy Technology Laboratory/URS $242,440
2012-2013
PI: R.C. Capo (University of Pittsburgh)
Co-I: B.W. Stewart

Natural isotope tracers for quantitative MVA
DOE-National Energy Technology Laboratory/URS $40,150
2012-2013
PI: B.W. Stewart (no Co-I)

Optimizing parameters for predicting the geochemical behavior and performance of discrete fracture networks in geothermal systems
DOE- Energy Efficiency and Renewable Energy (EERE) University of Pittsburgh: $215,661
2011-2014 Total: ~$1.0M
PI: J.A. Hakala (NETL)
Co-Is: R.C. Capo, B.W. Stewart (University of Pittsburgh); G. Bromhal, D. Crandall, B. Kutchko, C. Lopano, K. Rose, E. Rosenbaum, Y. Seol (DOE-NETL), L. Li (The Pennsylvania State University), S. Sharma (West Virginia University)

Natural isotope tracers for quantitative MVA
DOE-National Energy Technology Laboratory/URS $102,054
2011-2012
PI: B.W. Stewart (no Co-I)

Development of rapid analysis methods for Sr isotopes in complex geologic fluids using multicollector ICP-MS techniques
DOE-National Energy Technology Laboratory/URS $85,953
2011-2012
PI: B.W. Stewart (no Co-I)

Geochemical and isotopic baseline assessment of watersheds potentially impacted by Marcellus Shale gas development
Colcom Foundation- Marcellus Environmental Fund — University of Pittsburgh: $66,622
2011-2013 — Total: $169,042
PI: C. Kirby (Bucknell University)
Co-Is: R.C. Capo, B.W. Stewart (University Pittsburgh); J. Graney (Binghamton University)

Management of co-produced waters from the Marcellus Shale: Natural metal isotope tracking of water sources and implications for enhancing efficiency of hydrofrac procedures
DOE-National Energy Technology Laboratory/URS — $39,997
2010-2011
PI: B.W. Stewart (no Co-I)

Development of new natural isotope tracers for quantitative MVA
DOE-National Energy Technology Laboratory/URS — $99,987
2010-2011
PI: B.W. Stewart (no Co-I)

Novel geochemical tools to predict and monitor fate and impact of subsurface CO_2
DOE-National Energy Technology Laboratory/URS — $135,000
2010-2011
PI: R.C. Capo (University of Pittsburgh)
Co-Is: B.W. Stewart; D.J. Vesper (West Virginia University)

Regional collaboratory for the study of trace elements associated with fossil fuels and utilization byproducts
DOE-National Energy Technology Laboratory/RDS — University of Pittsburgh: $327,970
2006-2009 — Total: $621,970
PI: B.W. Stewart
Co-Is: R.C. Capo (University of Pittsburgh); D.J. Vesper, F. King (West Virginia University)

Technician support: Geochemistry laboratories at the University of Pittsburgh, Phase II
National Science Foundation – Instrumentation and Facilities Program — $83,079
2005 -2008
PI: R.C. Capo (University of Pittsburgh)
Co-I: B.W. Stewart (University of Pittsburgh)

Role of rainfall on the geochemical evolution of soils: The Atacama Desert of Chile
UC Berkeley Subcontract - National Science Foundation — University of Pittsburgh: $12,000
2005 -2007 — Total: $468,343
PI: R. Amundson (UC Berkeley)
Co-PI: K. Nishiizumi (UC Berkeley)
Subcontract PI: B.W. Stewart

Supplemental request: Repair of thermal ionization mass spectrometer for iron isotope analyses
National Science Foundation – Instrumentation and Facilities Program — $25,234
2005
PI: R.C. Capo (University of Pittsburgh)
Co-I: B.W. Stewart

Evolution of a habitable planet
NASA Origins Program – Astrobiology Institute — University of Pittsburgh: $230,972
2003-2009 — Total: ~$5.7M
PI: H. Ohmoto (The Pennsylvania State University)
Co-Is: 14 from Penn State; B.W. Stewart, R.C. Capo (University of Pittsburgh); M. Schoonen (SUNY Stony Brook)

Collaborative Research: Field and experimental iron isotope investigation of sedimentary pyrite dissolution in Appalachian coal mine drainage
National Science Foundation – Hydrology Program — University of Pittsburgh: $75,979
2003-2005 — Total: $159,979
Joint PIs: R.C. Capo (University of Pittsburgh); D.A. Dzombak (Carnegie Mellon University)
Co-I: B.W. Stewart

Technician support: Geochemistry laboratories at the University of Pittsburgh, Phase I
National Science Foundation – Instrumentation and Facilities Program $118,347
2002-2005
PI: R.C. Capo (University of Pittsburgh)
Co-I: B.W. Stewart

Miniature in situ geochronology instrument for planetary surface deployment: Breadboard development
NASA Planetary Instrument Development and Definition Program University of Pittsburgh: $121,622
1999-2001 Total: $396,622
PI: B.W. Stewart
Co-Is: G. Cardell, M. Sinha (JPL); R.C. Capo, D. Crown (University of Pittsburgh)

Quaternary paleohydrology of the western Great Basin Province, U.S.A
National Science Foundation – Geology & Paleontology Program $142,629
1999-2002
PI: B.W. Stewart (no Co-I)

Establishment of the Penn State Astrobiology Center
NASA Origins Program – Astrobiology Institute University of Pittsburgh $345,000
1998-2003 Total: ~$5.0M
PI: H. Ohmoto (The Pennsylvania State University)
Co-Is: 12 from Penn State; B.W. Stewart, R.C. Capo (University of Pittsburgh); M. Schoonen (SUNY Stony Brook)

In situ geochronology instrument (ISGI): laser ablation development
JPL/Caltech Center for Space Microelectronics $20,000
1998-1999
PI: B.W. Stewart
Co-I: R.C. Capo (University of Pittsburgh)

Development of variable environment laser ablation system for Mars in situ geochronology instrument
JPL/Caltech Center for Space Microelectronics $36,736
1997-1998
PI: B.W. Stewart
Co-I: R.C. Capo (University of Pittsburgh)

In-situ miniature age dating laboratory development
JPL/Caltech Mini-Directors Research Development Fund $21,931
1997-1998
PI: B.W. Stewart
Co-I: R.C. Capo (University of Pittsburgh)

Acquisition of a thermal ionization mass spectrometer
National Science Foundation – Instrumentation and Facilities Program $275,000
1997-1998
PI: R.C. Capo (University of Pittsburgh)
Co-I: B.W. Stewart

INTERNAL (UNIVERSITY OF PITTSBURGH) FUNDING

Tracking invasive catfish migration in Chesapeake Bay waters using the geochemistry and strontium isotope composition of otoliths
University of Pittsburgh Central Research Development Fund $15,949
2015-2017
PI: B.W. Stewart (no Co-I)

RESEARCH CONFERENCE ABSTRACTS AND PROCEEDINGS

(presenter underlined; advised or co-advised postdoc† or student indicated)*

2022

Schaffer CR*, Capo RC, **Stewart BW**, Hedin BC, Vesper DJ, Cravotta III CA (2022) Multidecadal geochemical evolution of acid mine drainage in an Appalachian coal basin. *Geological Society of America Annual Meeting Abstracts with Programs 54(5),* Denver, CO; doi: 10.1130/abs/2022AM-381086

Dobra KS*, **Stewart BW**, Capo RC (2022) Leveraging barium isotopes to evaluate utility of freshwater bivalve shells as paleoenvironmental monitors of river geochemistry in the lower Allegheny River watershed, Pennsylvania. *Geological Society of America Annual Meeting Abstracts with Programs 54(5),* Denver, CO; doi: 10.1130/abs/2022AM-380352

Olson KJ, Chen CY, **Stewart BW**, McGee D, Lowenstein TK (2022) Geochemistry and paleohydrology of Searles Lake (California) tufa. *Geological Society of America Annual Meeting Abstracts with Programs 54(5),* Denver, CO; doi: 10.1130/abs/2022AM-383182

Gardiner JB, Xiong W, Wang J, Small M, **Stewart BW**, Capo RC, McAdams B, Hakala JA, Thomas RB (2022) Ensuring CO_2 storage and groundwater protection through water monitoring: applying geochemical and statistical tools. *Battelle Conference on Innovations in Climate Resilience*, Columbus, OH.

2021

Wang J, Xiong W, Small M, McAdams B, **Stewart BW**, Thomas RB, Hakala JA, Gardiner JB (2021) A Bayesian belief network (BBN) for subsurface geochemical modeling and CO_2 leak detection. *American Geophysical Union Fall Meeting, New Orleans, Louisiana,* Abstract SY33B-06.

Xiong W, Wang J, Small M, McAdams B, **Stewart BW**, Thomas RB, Hakala JA, Gardiner JB (2021) Modeling the geochemical impact of CO_2 leakage on groundwater from an aquifer with variable mineral compositions. *American Geophysical Union Fall Meeting, New Orleans, Louisiana,* Abstract SY35E-0652.

Matecha RM*, Xiong W, Capo RC, **Stewart BW**, Heck WF*, Lopano CL, Hakala JA (2021) Experimental investigation of Marcellus Shale interaction with fluids at downhole conditions using Ba isotopes. *Geological Society of America Annual Meeting Abstracts 58-4*, Portland, OR; doi: 10.1130/abs/2021AM-367084.

2020

Matecha RM*, Heck WF*, Capo RC, **Stewart BW**, Xiong W, Lopano CL, Hakala JA (2020) Experimental investigation of barium sources and fluid-rock interaction in unconventional Marcellus Shale wells using Ba isotopes. *Geological Society of America Annual Meeting (Fully Online)*.

Stewart BW, Capo RC, Phan TP, Matecha RM*, Hakala JA, Lopano CL (2020, *invited*) Origin of conventional and unconventional produced water brines in the Appalachian Basin, USA, using radiogenic and stable metal isotopes. *American Chemical Society Annual Meeting, Philadelphia, Pennsylvania,* Abstract accepted, meeting cancelled due to COVID-19.

Phan TT, Sharma S, Gardiner JB, Thomas RB, Stuckman M, **Stewart BW**, Capo RC, Lopano CL, Hakala JA (2020) Applying geochemical and isotopic signals for monitoring CO_2 and brine leakage at a CO_2 flooding oil field in Texas, USA. *American Chemical Society Annual Meeting, Philadelphia, Pennsylvania,* Abstract accepted, meeting cancelled due to COVID-19.

2019

Stewart BW, Tieman ZG*, Capo RC, Matecha RM*, Phan TP, Lopano CL, Hakala JA (2019) Determining sources of barium and other dissolved solids in oil and gas produced water using stable barium isotopes. *Geological Society of America Annual Meeting, Phoenix, AZ: Geol. Soc. Am. Abstr. Prog. 51(5)*, 92-12.

Phan TT, Sharma S, Gardiner JB, Thomas RB, Stuckman M, **Stewart BW**, Capo RC, Lopano CL, Hakala JA (2019) Assessing the usefulness of multiple isotope systems (C, O, Li, B, Sr) for CO_2 and brine leakage monitoring at a CO_2 flooding oil field in Texas, USA. *Geological Association of Canada/Mineralogical Association of Canada Annual Meeting, Quebec, Canada*.

2017

Phan TT†, Capo RC, Gardiner JB*, **Stewart BW** (2017) Sediment sources, depositional environment, and diagenetic alteration of the Marcellus Shale, Appalachian Basin, USA: Nd, Sr, Li and U isotopic constraints. *American Geophysical Union Fall Meeting, San Francisco, California,* Abstract PP14A-05.

Wallrich ILR*, **Stewart BW**, Capo RC, Phan TT†, Hedin BC* (2017) Nd isotopes track rare earth element sources in acid mine drainage, Appalachian Basin, USA. *International Goldschmidt Geochemistry Conference, Paris, France.* Abstract #4124.

Hedin BC*, Capo RC, **Stewart BW**, Cravotta CA III, Hawkins JW, Hedin RS (2017) Cation exchange as a control on coal mine drainage geochemistry in the Appalachian region, eastern USA. *International Goldschmidt Geochemistry Conference, Paris, France.* Abstract #1582.

Mackey JE*, **Stewart BW** (2017) Evidence for the global SPICE event in passive margin carbonate and shale in the Appalachian Basin, USA. *International Goldschmidt Geochemistry Conference, Paris, France.* Abstract #2517.

McGrath MM*, **Stewart BW**, Sanchez MS (2017) Unraveling the petrogenesis of ore body talc deposits: A geochemical and petrological study. *Geological Society of America Northeast-North Central Joint Meeting, Pittsburgh, PA.*

Tieman ZG*, **Stewart BW**, Phan TT†, Capo RC, Hakala JA, Lopano CL (2017) Sources of Ba in the Marcellus Shale and associated produced waters. *Geological Society of America Northeast-North Central Joint Meeting, Pittsburgh, PA*.

2016

Mackey JE*, **Stewart BW** (2016) A Late Cambrian carbon isotope excursion recorded in passive margin dolostones of the central Appalachian Basin, USA. *American Geophysical Union Fall Meeting, San Francisco, California,* Abstract PP51C-2314.

Stewart BW, Capo RC, Hedin BC*, Wallrich, ILR*, Hedin, RS (2016) Production and precipitation of rare earth elements in acidic to alkaline coal mine discharges, Appalachian Basin, USA. *American Geophysical Union Fall Meeting, San Francisco, California,* Abstract B53K-03.

Stewart BW, Capo RC, Phan TT, Hakala JA (2016, *invited*) Deposition, hydrocarbon formation, and water-rock interaction in the Appalachian Basin, USA: Geochemical and multi-isotope tools. *American Chemical Society Annual Meeting, Philadelphia, Pennsylvania,* Abstract GEOC-27.

Stewart BW, Capo RC, Hedin BC*, Hedin RS (2016) Controls on rare earth elements in abandoned coal mine drainage in the Appalachian Basin, eastern USA. *International Goldschmidt Geochemistry Conference, Yokohama, Japan.*

2015

Stewart BW, Capo RC (2015) The origin and mobilization of late-stage produced waters from unconventional shale reservoirs. *Geological Society of America Annual Meeting, Baltimore, MD: Geol. Soc. Am. Abstr. Prog. 47*.

Phan TT†, Capo RC, **Stewart BW**, Macpherson GL, Rowan EL, Hammack RW (2015) Elevated Li and behavior of its isotopes in formation brines and host rocks of Marcellus Shale, Appalachian Basin. *American Association of Petroleum Geologists (AAPG) Annual Convention and Exhibition, Denver, CO.*

2014

Pfister S*, Gardiner JB*, Phan TT†, Macpherson GL, Diehl JR, Lopano CL, **Stewart BW**, Capo RC (2014) Geochemical effects of CO_2 injection on produced water chemistry at an enhanced oil recovery site in the Permian Basin of northwest Texas, USA: Preliminary geochemical and Li isotope results. *American Geophysical Union Fall Meeting, San Francisco, California,* Abstract # H21A-0723.

Stewart BW, Capo RC (2014) Dissecting black shales and associated fluids from the Middle Devonian Marcellus Formation, Appalachian basin, USA. *Geological Society of America Annual Meeting, Vancouver, Canada: Geol. Soc. Am. Abstr. Prog. 46(6):* 71.

Capo RC, **Stewart BW** (2014) Geochemistry of geologic carbon storage from enhanced oil recovery and high-CO_2 natural analogue sites. *DOE/NETL Carbon Storage R&D Project Review Meeting: Developing the Technologies and Infrastructure for CCS. Pittsburgh, Pennsylvania.*

Capo RC, Kolesar Kohl, CA*, **Stewart, BW**, Wall, AJ†, Schroeder, KT, Hammack, RW, Guthrie, GD (2014) Geochemical characterization and assessment of migration or mixing of Upper and Middle Devonian produced waters following horizontal drilling and hydraulic fracturing. *International Goldschmidt Geochemistry Conference, Sacramento, California, Abstract #339.*

2013

Stewart BW, Capo RC, Brubaker TM*, Spivak-Birndorf LJ*, Schroeder KT, Vesper DJ, Chapman EC*, Cardone CR, Rohar PC (2013, *invited*) Geochemical and strontium isotope investigation of coal utilization by-products interacting with aqueous fluids: Laboratory leaching experiments. *Geological Society of America Annual Meeting, Denver CO: Geol. Soc. Am. Abstr. Prog. 45(7)*: 498.

Rowan EL, Engle MA, Kraemer TF, Capo RC, **Stewart BW**, Hammack RW, Schroeder KT (2013) Geochemistry and isotopic composition of produced water from Marcellus Shale wells in southwest and north-central Pennsylvania. *Geological Society of America Annual Meeting, Denver CO: Geol. Soc. Am. Abstr. Prog. 45(7)*: 76.

Stewart BW, Capo RC, Chapman EC*, Phan TT†, Gardiner JB*, Johnson JD, Graney JR, Sharma S, Toro J (2013) Experimental fluid-rock studies of natural gas-bearing black shales and application to paleoenvironment, formation fluids, and environmental impacts of hydraulic fracturing *10th International Symposium on Applied Isotope Geochemistry (AIG-10), Budapest, Hungary*.

Capo RC, **Stewart BW**, Rowan E, Kolesar CA*, Wall AJ†, Chapman EC*, Hammack RW, Schroeder KT (2013) Application of the Sr isotopic composition of produced waters from Upper and Middle Devonian gas wells as a tracer of subsurface reactions *10th International Symposium on Applied Isotope Geochemistry (AIG-10), Budapest, Hungary*.

Stewart BW, Chapman EC*, Capo RC, Graney JR, Johnson JD (2013) Origin of dissolved solids in Marcellus shale produced water. *International Goldschmidt Geochemistry Conference, Florence, Italy. Mineralogical Magazine 77(5)*: 2264.

Phan TT†, Capo RC, **Stewart BW**, Sharma S, Toro J (2013) Uranium partitioning and isotope composition in shales of the Middle Devonian Marcellus Formation. *International Goldschmidt Geochemistry Conference, Florence, Italy. Mineralogical Magazine 77(5)*: 1965.

Kolesar CA*, Capo RC, Wall AJ†, **Stewart BW**, Schroeder KT, Hammack RW (2013) Using strontium isotopes to test stratigraphic isolation of injected and formation waters during hydraulic fracturing. *American Association of Petroleum Geologists (AAPG) Annual Convention and Exhibition, Pittsburgh, PA.*

Macpherson GL, Capo RC, **Stewart BW**, Phan TT†, Schroeder KT, Hammack RW (2013) δ^7Li of saline water: Northern Appalachian Basin and Gulf Coast Sedimentary Basin, USA. *American Association of Petroleum Geologists (AAPG) Annual Convention and Exhibition, Pittsburgh, PA.*

Capo RC, **Stewart BW**, Rowan E, Wall AJ†, Chapman EC*, Schroeder KT, Hammack RW (2013) The strontium isotopic and geochemical evolution of produced waters from the Marcellus Formation. *American Association of Petroleum Geologists (AAPG) Annual Convention and Exhibition, Pittsburgh, PA.*

Wall AJ†, Capo RC, **Stewart BW**, Lavin SM, Hakala JA, Schroeder KT, Casson LW, Monnell J (2013) Using strontium isotopes to identify Marcellus shale-derived fluids in Allegheny River watershed, Pennsylvania, USA. *Geological Society of America Northeast Section Meeting, Bretton Woods, NH.*

2012

Wall AJ†, Capo RC, **Stewart BW**, Lavin SM*, Hakala JA, Schroeder KT, Casson LW, Monnell JD, States S (2012) A baseline geochemical and Sr isotope assessment of surface waters in the Allegheny River watershed, Pennsylvania, USA. *American Geophysical Union Fall Meeting, San Francisco, CA: H34B-06, 1499551.*

Capo RC, Wall AJ†, **Stewart BW**, Phan TT†, Jain JC, Hakala JA, Guthrie GD (2012) High throughput strontium isotope method for monitoring fluid flow related to geological carbon storage. *American Geophysical Union Fall Meeting, San Francisco, CA: H23A-1343, 1501936.*

Stewart BW, Capo RC, Chapman EC*, Hammack RW, Schroeder KT, Wall AJ†, Macpherson GL, Phan TT†, Gardiner JB* (2012, *invited*) Isotope tracers to identify origin and verify safe disposal of produced water from the Middle Devonian Marcellus Formation, Pennsylvania, USA. *Geological Society of America Annual Meeting, Charlotte, NC, Pardee Symposium: Geol. Soc. Am. Abstr. Prog. 44(7)*: 338.

Gardiner JB*, **Stewart BW**, Capo RC, Phan TT†, Sharma S, Toro J (2012) A neodymium isotope investigation of sediment sources for the Middle Devonian Marcellus Formation, Pennsylvania, USA. *Geological Society of America Annual Meeting, Charlotte, N C: Geol. Soc. Am. Abstr. Prog. 44(7)*: 314.

Phan TT†, **Stewart BW**, Capo RC, Gardiner JB*, Sharma S. Toro J (2012) Uranium isotope variations in shale and carbonate of the Middle Devonian Marcellus Formation, Pennsylvania, USA. *Geological Society of America Annual Meeting, Charlotte, N C: Geol. Soc. Am. Abstr. Prog. 44(7)*: 313.

Phan TT†, Capo RC, **Stewart BW**, Gardiner JB*, Macpherson GL, Hakala JA, Keating EH (2012) CO_2 leakage impacts on shallow groundwater: Application of uranium isotope composition to track the origin and mobility of U at a natural analog site, Chimayo, NM. *Geological Society of America Annual Meeting, Charlotte, N C: Geol. Soc. Am. Abstr. Prog. 44(7)*: 191.

Macpherson GL, Capo RC, **Stewart BW**, Phan TT†, Schroeder KT, Hammack RW (2012) Lithium concentrations and isotope ratios in produced water from the Marcellus Formation, Pennsylvania, USA. *Geological Society of America Annual Meeting, Charlotte, N C: Geol. Soc. Am. Abstr. Prog. 44(7)*: 315.

Flannery KF*, Wall AJ†, Lavin SM*, Capo RC, **Stewart BW** (2012) Iron isotope variations during oxidative dissolution of arsenopyrite. *Geological Society of America Annual Meeting, Charlotte, NC: Geol. Soc. Am. Abstr. Prog. 44(7)*: 52.

Wall AJ†, Jain J, **Stewart BW**, Capo RC, Hakala JA, Hammack R, Guthrie G (2012) Development of high through-put Sr isotope analysis for monitoring reservoir integrity for CO_2 storage. *11th Annual Carbon Capture, Utilization & Sequestration Conference (CCUS), Pittsburgh, PA*: #239.

2011

Wall AJ†, **Stewart BW**, Capo RC, Hakala JA, Guthrie G (2011) Development of radiogenic and non-traditional stable isotope systems for Monitoring, Verification, and Accounting. *DOE Carbon Storage Program Infrastructure Annual Review & Meeting, Pittsburgh, PA:* Poster #2.18.

Cole RB, **Stewart BW**, Layer PW (2011) Early Cenozoic Talkeetna Mountains magmatism in south-central Alaska: Record of crust-mantle variations, terrane accretion, and pluton exhumation. *Geological Society of America Annual Meeting, Minneapolis, MN: Geol. Soc. Am. Abstr. Prog.* 230-9.

Chapman EC*, Capo RC, **Stewart BW**, Johnson JD, Graney JR, Hammack RW (2011) Geochemical and strontium isotope study of sequentially extracted metals from Marcellus Shale drill core. *Geological Society of America Annual Meeting, Minneapolis, MN: Geol. Soc. Am. Abstr. Prog.* 236-3.

Capo RC, **Stewart BW**, Chapman EC*, Gardiner JB*, Spivak-Birndorf L*, Brubaker TM*, Hammack RW, Schroeder KT, Hakala JA, Edenborn HM (2011) Environmental tracking of fossil fuel-related northern Appalachian waters using strontium isotopes. *9th International Symposium on Applied Isotope Geochemistry (AIG-9), Tarragona, Spain: Abstr. Prog.* p 41.

Stewart BW, Chapman EC*, Capo RC, Hammack RW, Schroeder KT, Edenborn HM (2011) Strontium isotopic signatures of flowback and co-produced waters associated with Marcellus Shale natural gas extraction, Pennsylvania. *American Association of Petroleum Geologists Eastern Section Meeting, Washington, DC* (***winner of AAPG Division of Environmental Geosciences Best Paper Award, Eastern Section***).

Stewart BW, Chapman EC*, Capo RC, Hammack RW, Schroeder KT, Edenborn HM (2011) Origin of dissolved metals in produced water from the Devonian Marcellus shale, USA: Sr isotope systematics. *International Goldschmidt Geochemistry Conference, Prague, Czech Republic: Min. Mag. 75:* 1942.

Chapman EC*, Capo RC, **Stewart BW**, Kirby CS, Engle MA, Rowan EL, Edenborn HM (2011) Strontium isotopic composition of flowback waters associated with Marcellus Shale natural gas extraction, Bradford County, Pennsylvania. *Geological Society of America Northeast/North-Central Section Meeting, Pittsburgh, PA: Geol. Soc. Am. Abstr. Prog. 43(1)*: 76.

2010

Keating EH, Hakala JA, Viswanathan, H, Capo RC, **Stewart BW**, Gardiner JB*, Carey JW, Fessenden J (2010) The challenge of predicting groundwater quality impacts in CO_2 leakage scenarios: Results from field,

laboratory, and modeling studies at a natural analog site in New Mexico, USA. *Geological Society of America Annual Meeting, Denver, CO: Geol Soc. Am. Abstr. Prog*. 42(5): 44.

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Gardiner JB*, **Stewart BW**, Capo RC, Hakala JA, Keating EH (2010) Tracking CO2 migration through a sandstone aquifer using Sr isotopes: Chimayó, New Mexico, USA. *Goldschmidt 2010: Earth, Energy, and the Environment, Knoxville, TN: Geochim. Cosmochim. Acta 74:11, Suppl. 1*: A320.

Chapman EC*, Capo RC, **Stewart BW**, Hedin RS, Weaver TJ, Edenborn HM (2010) Sr isotope quantification of siderite, brine and AMD contribution to high TDS well discharges. *Goldschmidt 2010: Earth, Energy, and the Environment, Knoxville, TN: Geochim. Cosmochim. Acta 74:11, Suppl. 1*: A161.

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Chapman EC*, Capo RC, **Stewart BW**, Hedin R, Weaver T (2009) Sr isotope quantification of deep brine and shallow acidic coal mine drainage inputs to high TDS gas well discharges in western Pennsylvania. *American Geophysical Union Fall Meeting, San Francisco, CA: Eos, Trans. Am. Geophys. Union*, *90(52), Fall Meet. Suppl.*, H51I-0907.

Gardiner JB*, **Stewart BW**, Capo RC, Hakala JA (2009) Strontium isotope tracking of groundwater-CO2 interactions in Chimayo, New Mexico, and implications for carbon storage in geologic formations. *American Geophysical Union Fall Meeting, San Francisco, CA: Eos, Trans. Am. Geophys. Union*, *90(52), Fall Meet. Suppl.*, H13A-0912.

Quick DJ[v], Chadwick OA, **Stewart BW**, Reheis M (2009) Impact of one hundred years of Owens Lake playa dust on nearby alluvial soils. *American Geophysical Union Fall Meeting, San Francisco, CA: Eos, Trans. Am. Geophys. Union*, *90(52), Fall Meet. Suppl.*, EP24A-04.

Stewart BW, Hynicka J*, Ewing S, Amundson R (2009) Radiogenic isotope provenance of dry deposition in hyperarid soils of the Atacama Desert, Chile. *American Society of Agronomy (ASA-CSSA-SSSA) Annual Meeting, Pittsburgh, PA:* #55908.

Stewart BW, Capo RC (2009, *invited*) Radiogenic Isotopes as Tracers: A History of Applications From Planetary Differentiation to Pedogenesis. *American Society of Agronomy (ASA-CSSA-SSSA) Annual Meeting, Pittsburgh, PA:* #54671.

Johnson IM, Watanabe Y, **Stewart BW**, Ohmoto H (2009) Earth's oldest (~3.4 Ga) lateritic paleosol in the Pilbara Craton, Western Australia. *19th Annual Goldschmidt Conference, Davos, Switzerland: Geochim. Cosmochim. Acta 73, Suppl. 1*: A601.

2008

Stewart BW, Capo RC (2008) Strontium isotope tracking of Pleistocene solute sources in Great Basin pluvial systems: Results from Searles Lake, eastern California. *American Geophysical Union Fall Meeting, San Francisco, CA: Eos, Trans. Am. Geophys. Union*: PP13C-1461.

Chapman EC*, **Stewart BW**, Capo RC, Brubaker TM*, Spivak-Birndorf L*, Schroeder KT (2008) Significant shifts in boron isotope ratios during column leaching of coal fly ash. *Geological Society of America Annual Meeting, Houston, TX: Geol. Soc. Am. Abstr. Prog.* 272-13.

Brubaker TM*, Chapman EC*, **Stewart BW**, Capo RC, Spivak-Birndorf L*, Schroeder KT (2008) Strontium Isotope Tracking of coal utilization by-product (CUB) interactions with environmental waters: Results from column leaching experiments. *Geological Society of America Annual Meeting, Houston, TX: Geol. Soc. Am. Abstr. Prog.* 247-13.

Hynicka JD*, **Stewart BW**, Ewing S, Amundson R (2008) Tracking the provenance of soil nutrients in arid to hyperarid soils of the Atacama Desert, Chile, using strontium isotopes. *Geological Society of America Annual Meeting, Houston, TX: Geol. Soc. Am. Abstr. Prog.* 51-5.

Ewing SA, Amundson R., **Stewart BW**, Thiemens M, DePaolo DJ (2008) Ca isotopes and the rainfall limit of silicate weathering on Earth. *18th Annual Goldschmidt Conference, Vancouver, Canada: Geochim. Cosmochim. Acta 72, Suppl. 1, A249*.

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Wolfe AL*, Liu R, **Stewart BW**, Capo RC, Dzombak DA (2008) Fe isotope investigation of the pyrite lifecycle. *NASA Astrobiology Institute Annual Meeting*, Santa Clara, CA.

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Liu R, Wolfe A*, Dzombak DA, **Stewart BW**, Capo RC (2006) Rate and extent of dissolution of various sedimentary and hydrothermal pyrite samples. *American Chemical Society Fall Meeting, San Francisco, CA*.

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Stafford SL*, Capo RC, **Stewart BW**, Macpherson GL, Ohmoto H (1999) Micromorphology and geochemistry of an apparent Archean weathering profile, Ontario, Canada. *American Geophysical Union Fall Meeting, San Francisco, CA: EOS, Trans. Am. Geophys. Union*, **80**, F1167.

Stewart BW, Capo RC, Watanabe Y, Ohmoto H (1999) Provenance of a 2.6 Ga terrestrial carbonate sequence from the eastern Transvaal region, South Africa. *American Geophysical Union Fall Meeting, San Francisco, CA: EOS, Trans. Am. Geophys. Union*, **80**, F69-70.

Stafford SL*, Capo RC, **Stewart BW**, Hedin R (1999) Strontium isotopic ratios trace alkaline addition to coal mine drainage. *Ninth International Goldschmidt Geochemistry Conference, Harvard University, Cambridge, MA: Lunar Planetary Institute Contribution No. 971,* 283.

Stewart BW (1998) Quaternary weathering processes and climate change in the Sierra Nevada and western Great Basin: Radiogenic isotope results from the Owens River system. *Geological Society of America Annual Meeting, Toronto, Canada: Geol. Soc. Am. Abstr. Prog.* **30**, A66.

Capo RC, **Stewart BW**, Chadwick OA (1998) Delivery of dust and labile cations to desert surfaces: The soil carbonate record. *Geological Society of America Annual Meeting, Toronto, Canada: Geol. Soc. Am. Abstr. Prog.* **30**, A100.

Yurko ML*, Stafford SL, **Stewart BW**, Capo RC, Rollins HB (1998) Trace element and strontium isotope composition in freshwater mussels as a record of environmental change. *Geological Society of America Annual Meeting, Toronto, Canada: Geol. Soc. Am. Abstr. Prog.* **30**, A181-A182.

Stewart BW, Capo RC, Chadwick OA (1997, invited) Quantifying weathering rates using strontium isotopes: A tale of two parent materials. *Geological Society of America Cordilleran Section Meeting, Kona, HI: Geol. Soc. Am. Abstr. Prog.* **29**, no. 5, 67.

Capo RC, **Stewart BW**, Chadwick OA (1997) Silicate weathering rates and atmospheric strontium fluxes: A comparison of arid sites in Hawai'i and New Mexico. *Seventh International Goldschmidt Geochemistry Conference, Tucson, AZ*: *LPI Contribution No. 921, Lunar and Planetary Institute,* 41-42.

Stewart BW (1996) Dissolved cation sources in a Plio-Pleistocene salt pan, Death Valley, California. *American Geophysical Union Fall Meeting, San Francisco, CA: EOS, Trans. Am. Geophys. Union* **77**, 304.

Stewart BW, Graham RC, Chadwick OA (1995) Fluxes and transport of plant-available strontium in soil from the San Dimas Experimental Forest, California. *Fifth International Goldschmidt Geochemistry Conference, State College, PA: Prog. Abstr.* 90.

Stewart BW, Chadwick OA, Graham RC (1994) Strontium isotope study of cation fluxes in a soil-vegetation-atmosphere system. *Eighth International Conference on Geochronology, Cosmochronology & Isotope Geology (ICOG-7), Berkeley, CA.: U.S. Geol. Surv. Circular* **1107**, 305.

Stewart BW, Hsieh JCC, Murray BC (1994) Paleohydrology of the late Pliocene Basin and Range province using strontium isotopes. *Eighth International Conference on Geochronology, Cosmochronology & Isotope Geology (ICOG-7), Berkeley, CA: U.S. Geol. Surv. Circular* **1107**, 305.

Capo RC, **Stewart BW**, Chadwick OA (1994) Strontium isotopes as a tracer of land surface processes: Theoretical aspects. *American Society of Agronomy (ASA-CSSA-SSSA) 86th Annual Meeting, Seattle, WA: Agronomy Abstracts 86*, 345 (invited abstract).

Stewart BW, Chadwick OA, Capo RC (1994) Use of strontium isotopes for study of the soil-vegetation-atmosphere system. *American Society of Agronomy (ASA-CSSA-SSSA) 86th Annual Meeting, Seattle, WA: Agronomy Abstracts 86*, 345 (invited abstract).

Stewart BW, Papanastassiou DA, Capo RC, Wasserburg GJ (1993) Fine resolution chronology based on initial $^{87}Sr/^{86}Sr$. *Lunar and Planetary Science Conference, Houston, TX: Lunar Planet. Sci.* **XXIV**, 1357-1358.

Stewart BW, Papanastassiou DA, Wasserburg GJ (1993) Sm-Nd systematics of silicate inclusions in iron meteorites: Results from Caddo (IAB). *Lunar and Planetary Science Conference, Houston, TX: Lunar Planet. Sci.* **XXIV**, 1359-1360.

Stewart BW, Chadwick OA, Graham RC (1993) Application of radiogenic isotopes to the evolution of a soil-vegetation-atmosphere system on a decade time scale. *Geological Society of America Annual Meeting, Boston, MA: Geol. Soc. Am. Abstr. Prog.* **25**, A88.

Stewart BW, Hsieh JCC, Murray BC (1993) Strontium isotope record of cation sources in Plio-Pleistocene lacustrine evaporite deposits, Death Valley, California. *Geological Society of America Annual Meeting, Boston, MA: Geol. Soc. Am. Abstr. Prog.* **25**, A455-A456.

Stewart BW, Chadwick OA, Graham RC (1993) Cation fluxes and soil weathering on a decade time scale: Application of strontium isotopes. *American Geophysical Union Fall Meeting, San Francisco, CA: EOS, Trans. Am. Geophys. Union* **74**, 244.

Kennedy AK, **Stewart BW**, Hutcheon ID, Papanastassiou DA, Wasserburg GJ (1992) Partitioning of REE between phosphates and silicates in mesosiderites: Evidence for differing degrees of equilibration. *Lunar and Planetary Science Conference, Houston, TX: Lunar Planet. Sci.* **XXIII**, 681-682.

Stewart BW, Papanastassiou DA, Wasserburg GJ (1992) Sm-Nd chronology and petrochemistry of mesosiderites. *Lunar and Planetary Science Conference, Houston, TX: Lunar Planet. Sci.* **XXIII**, 1365-1366.

Stewart BW, Bebout GE, Grove M (1992) Miocene magmatism in a transcurrent tectonic setting: Isotopic data from Santa Catalina Island, California. *American Geophysical Union Spring Meeting, Montreal, Canada: EOS, Trans. Am. Geophys. Union* **73**, 338.

Stewart BW, Cheng QC, Papanastassiou DA, Wasserburg GJ (1991) Sm-Nd systematics of mesosiderites. *Lunar and Planetary Science Conference, Houston, TX: Lunar Planet. Sci.* **XXII**, 1333-1334.

Kennedy AK, **Stewart BW**, Hutcheon ID, Wasserburg GJ (1991) Trace element partitioning within mesosiderite clasts. *Meteoritical Society Annual Meeting, Monterey, CA: Meteoritics* **26**, 356.

Stewart, BW, DePaolo DJ (1991) Decoupling of chemical and isotopic exchange in the Muskox intrusion, Northwest Territories, Canada. *Geological Society of America Annual Meeting, San Diego, CA: Geol. Soc. Am. Abstr. Prog.* **23**, A270.

Stewart BW, DePaolo DJ (1990) Isotopic constraints on the interaction of basaltic magma and continental crust. *Seventh International Conference on Geochronology, Cosmochronology & Isotope Geology (ICOG-7), Canberra, Australia: Geol. Soc. Australia Abstr.* **27**, 95.

Stewart, BW, DePaolo DJ (1990) Liquid evolution in a multiply-recharged magmatic system: Isotopic evidence from the Muskox intrusion, Canada. *Geological Society of America Annual Meeting, Dallas, TX: Geol. Soc. Am. Abstr. Prog.* **22**, A256.

Stewart, BW, DePaolo DJ (1989) Mafic magma chamber geometries and processes: Nd and Sr isotope evidence and constraints. *28th International Geological Congress, Washington DC: Sci. & Tech. Progr. Abstr.* **3**, 181

Stewart, BW, DePaolo DJ (1989) Mixing of mafic and silicic magmas in magma chambers: Nd and Sr isotopic constraints. *Geological Society of America Annual Meeting, St. Louis, MO: Geol. Soc. Am. Abstr. Prog.* **21**, A263.

Stewart BW, DePaolo DJ (1988) Sm-Nd age and Nd and Sr isotopic variations within the Muskox intrusion, Northwest Territories, Canada. *Geological Society of America Annual Meeting, Denver, CO: Geol. Soc. Am. Abstr. Prog.* **20**, A156.

Stewart BW, DePaolo DJ (1987) Sr isotope stratigraphy of the Stillwater complex, Montana: Evidence for multiple magma injections. *American Geophysical Union Spring Meeting, Baltimore, MD: EOS, Trans. Am. Geophys. Union* **68**, 429.

Stewart BW, DePaolo DJ (1986) Nd and Sr isotope evidence for open system magmatic behavior of the Skaergaard intrusion. *Geological Society of America Annual Meeting, San Antonio, TX: Geol. Soc. Am. Abstr. Prog.* **18**, 764.

Stewart BW, DePaolo DJ (1985) A Nd and Sr isotopic study of the Skaergaard intrusion. *American Geophysical Union Fall Meeting, San Francisco, CA: EOS, Trans. Am. Geophys. Union* **66**, 1138.

Gromet LP, **Stewart BW** (1983) REE distribution among minerals in an amphibolite: Implications for subsolidus redistribution of REE in plutonic rocks. *Geological Society of America Annual Meeting, Indianapolis, IN: Geol. Soc. Am. Abstr. Prog.* **15**, 586.

INVITED PRESENTATIONS: WORKSHOPS AND COLLOQUIA

The Case for Isotope Tracking of Produced Water
EPA Workshop: Research Activities on Produced Water Management, Penn State University (2018)

An Overview of Inorganic Geochemical Tools for Identifying and Quantifying the Interaction of Produced Water from Marcellus, Conventional, and Legacy Oil and Gas Wells with Streams and Groundwater in the Appalachian Basin

Shale Network Workshop, State College, Pennsylvania (2016)

Origin of Produced Water and Dissolved Solids from Hydraulically Fractured Shales of the Marcellus Formation
Miami University of Ohio: Department of Geology & Environmental Earth Science Colloquium (2013)

Isotope Studies of the Origin and Evolution of Dissolved Solids in Devonian Produced Waters
Pittsburgh Association of Petroleum Geologists (PAPG) Symposium: "Subsurface Fluid Migration from Hydraulic Fracturing: Mechanisms, Characteristics and Concerns" (2012)

Isotope Tracers for the Origin and Fate of Dissolved Solids in Produced Waters from the Marcellus Formation
Penn State University: Department of Geosciences Colloquium (2012)

The Strontium Isotope Fingerprint of Marcellus Brines
Duke University: NSF Workshop on the Environmental and Social Implications of Hydraulic Fracturing and Gas Drilling in the United States (2012)

Radiogenic Isotope Tracking of Dust Feeding the Arid to Hyperarid Soils of the Atacama Desert, Chile
University of Delaware: Joint Symposium of Departments of Plant & Soil Sciences/Geological Sciences (2009)

Provenance of Aerosols in the Arid Soils of the Atacama Desert, Chile: A Strontium Isotope Approach
University of Pittsburgh: Department of Geology & Planetary Science Colloquium series (2009)

Radiogenic Isotopes as Tracers: A History of Applications From Planetary Differentiation to Pedogenesis
American Society of Agronomy Annual Meeting, Pittsburgh: The History of Soil Mineralogy Symposium (2009)

Astrobiological Research at the University of Pittsburgh: What Ancient Soils Tell Us About the Evolution of Earth's Atmosphere
Pittsburgh Section, American Chemical Society: Chemists Club Symposium (2007)

An Isotopic Record of Quaternary Weathering in the Eastern Sierra Nevada: The Owens River System, California
Dartmouth College: Department of Earth Sciences Symposium (2003)

Solute Sources for Streams in the Eastern Sierra Nevada, California: Modern Weathering and the Quaternary Record Preserved in Playa Lakes
Cornell University: Department of Earth & Atmospheric Sciences Symposium (2003)

Rover-Based Geochemical and Geochronologic Analyses of Planetary Surfaces
Carnegie Mellon University: Robotics Research Seminar (1999)

In Situ Geochronology on Planetary Surfaces: Overview and Prospects for Instrument Development
NASA Campaign Strategy Working Group, Washington DC: Workshop on Evolution and Dynamics of Earth-like Planets (1998)

Measurement of Isotope Ratios by Thermal Ionization Mass Spectrometry
Spectroscopy Society of Pittsburgh/Society of Analytical Chemists of Pittsburgh: Forum on Inorganic Mass Spectrometry (1999)

Mass Spectrometry of Solid Samples: Considerations for In Situ Sampling
California Institute of Technology: Caltech/JPL Workshop on Planetary Surface Analysis (1997)

Strontium Isotope Modeling of Soil Evolution
University of Rochester: Department of Earth & Environmental Sciences Symposium (1996)

Isotope Geochronology: Applications to Meteorites
Jet Propulsion Laboratory: Microdevices Research Center Special Symposium (1996)

Isotopic Tracers of Weathering and Climate Change in the Soil-Vegetation-Atmosphere System
Brown University: Department of Geological Sciences Seminar (1994)

Chronology and Petrogenesis of Stony-Iron Meteorites
University of Pittsburgh: Department of Geology & Planetary Science Seminar (1994)

Application of Radiogenic Isotopes to Hydrologic and Pedologic Studies
State University of New York, Albany: Department of Geological Sciences Seminar (1994)

Chronology and Petrogenesis of Mesosiderite Meteorites: Clues from the Sm-Nd Isotope Systems
University of California, Los Angeles: Department of Earth & Space Sciences Geochemistry Seminar (1993)

Constraints on the Interaction Between Basaltic Magma and Continental Crust
Harvard University: Department of Earth & Planetary Sciences Seminar (1990)

Neodymium and Strontium Isotope Studies of Magma Chamber Processes
Massachusetts Institute of Technology: Department of Earth, Atmospheric and Planetary Science Seminar (1990)

SERVICE & SYNERGISTIC ACTIVITIES

Professional

Research Grants Committee, Geological Society of America (2020-2023)

Associate Editor, *Geochimica et Cosmochimica Acta* (2012-present)

Co-Convener:

Topical Session, Geological Society of America Annual Meeting, Montreal, Canada (Fully online due to COVID-19): *Geochemical Signatures of Fluid-Rock Interaction: Earth Surface Weathering to Hydrothermal Systems* (2020)

Topical Session, Geological Society of America Annual Meeting, Denver, CO: *Geochemistry of Flowback and Produced Waters from Hydraulically Fractured Black Shale* (2013)

Technical Session, AAPG Annual Meeting, Pittsburgh, PA: *Water Risks and Mitigation Strategies in Unconventional Development* (2013)

Pardee Symposium, Geological Society of America Annual Meeting, Charlotte, NC: *Shale Gas Development and Hydraulic Fracturing Impacts on Water Resources in the United States* (November 2012)

Special Session, International Goldschmidt Conference, Knoxville, TN: "*Geochemistry of CO_2 sequestration: Isotopic Indicators of Carbon Capture, Storage and Migration in Natural and Engineered Systems"* (2010)

Panel Reviewer, NASA - *Discovery Solar System Exploration Program* (2015)

Managing Guest Editor, *Applied Geochemistry* Special Issue: Geochemistry of Unconventional Shale Gas from Formation to Extraction: Petrogenesis, Hydraulic Fracturing, and Environmental Impacts (2014-2015)

Winner of AAPG Division of Environmental Geosciences Best Paper Award (Eastern Section): *American Association of Petroleum Geologists Eastern Section Meeting, Washington, DC* (2011)

Oak Ridge Institute for Science and Education (ORISE) Faculty Research Associate (2010-11)

Panel Reviewer, National Science Foundation *Geobiology & Low Temperature Geochemistry Program* (2006, 2007, 2008)

Institute Fellow, NETL-IAES: *DOE/NETL -University of Pittsburgh-Carnegie Mellon University-West Virginia University -- Institute for Advanced Energy Solutions* (2008-2009)

Visiting Scientist, Department of Earth and Atmospheric Sciences, Cornell University (Sabbatical, 2002-03)

Invited Participant, NASA/JPL Workshop, University of Illinois at Chicago: *Assessing Chronometric Techniques for Quantifying Surficial Processes on Mars* (2000)

Panel Reviewer, NASA PIDDP - *Planetary Instrument Definition and Development Program* (1999)

Manuscript reviews (1994-2022): *Analytical Chemistry, Applied Geochemistry, Chemical Geology, Colloids and Surfaces A, Earth & Planetary Science Letters, Environmental Science and Technology, European Journal of Soil Science, Geochemistry Geophysics Geosystems (G^3), Geochimica et Cosmochimica Acta, Geology, Geophysical Research Letters, Hydrogeology Journal, International Journal of Coal Geology, Journal of Geochemical Exploration, Journal of Geophysical Research, Journal of Petrology, Limnology & Oceanography Methods, Mountain Geologist, Nature Communications, Quaternary Research, Science, Scientific Reports, AGU Monographs*

Proposal reviews (1994-2019): *EREF (Environmental Research and Education Foundation), FWF (Austrian Science Fund), NASA Planetary Instrument Definition and Development Program*, *NSF Major Research Instrumentation, NSF Geobiology & Low Temperature Geochemistry, NSF Instrumentation & Facilities, NSF Hydrologic Sciences, NSF Geology & Paleontology, NSF Petrology & Geochemistry*

Professional Affiliations: *American Chemical Society, American Geophysical Union, Geochemical Society, Geological Society of America, International Association of Geochemistry, National Center for Science Education, Sigma Xi*

Department/University

Provost's Advisory Council on Undergraduate Programs (2019-2022)

Dieterich School of Arts & Sciences Undergraduate Council, elected member (2016-2019)

Chair, Department of Geology & Planetary Science, University of Pittsburgh (2005-2008) *See below.*

Department Tenure Committee Representative to University (2003-2004, 2012-2013, 2014-2017) *Participated in University of Pittsburgh Ad Hoc Tenure Committees and Tenure Appeal Committee*

Faculty Recruitment Committee, Department of Geology & Planetary Science (2002-2013) *Assisted in identifying suitable candidates; carried out interviews and dossier evaluations; helped coordinate startup packages for successful faculty candidates.*

Director of Graduate Studies, Department of Geology & Planetary Science (2001-2002; 2003-2005, 2008-2010) *Coordinated new student admissions; worked with Graduate Administrator to assign courses to Teaching Assistants/Fellows; coordinated annual graduate reviews after 2008; dealt with student-advisor conflicts.*

Graduate Studies Committee Chair, Department of Geology & Planetary Science (2003-2005) *Assisted with comprehensive rewriting of Department graduate requirements, including implementation of a new annual review by the Graduate Committee and initiation of written Preliminary Exam.*

Environmental Studies Executive Committee, Department of Geology & Planetary Science (1995-2008) *Co-founded Environmental Studies B.A. Program with four other faculty members, including development of program structure, curriculum, and interdisciplinary offerings; participated in fundraising efforts with Office of Institutional Development, culminating in successful $2 million Heinz Foundations endowment; assisted in recruitment of external Advisory Board members and subsequent Advisory Board meetings; participated in student recruitment efforts, brochure development, and description of university-wide Environmental Studies courses; worked on issues related to curriculum; dealt with budgeting from Heinz Endowment, including hiring of full-time Program Coordinator.*

Co-organizer, A.J. Sharkey Symposium (1997) *"Mass Spectrometry of the Earth and Environment" sponsored by the American Chemical Society and Spectroscopy Society of Pittsburgh. Featured world-renowned researchers in the field of mass spectrometry.*

Department Chair, 2005-2008

The following is a brief summary of accomplishments during my tenure as Department Chair:

- *Prepared and submitted successful tenure cases for two faculty members. Due to the small number of tenured faculty, I chaired the department tenure committee and prepared all of the necessary reports and documentation to the administration.*
- *Hired new faculty in the area of hydrology, after two previous attempts had been unsuccessful; this was the first split tenure stream position at the University of Pittsburgh, and it required careful work with the candidates and administration to work out the details of the hire. Identified appropriate laboratory space and worked with Administration and Department to provide timely renovations.*
- *Prepared new protocol and standardized form for annual faculty evaluations and pay raise allocation.*
- *Wrote and shepherded through Department Bylaws, the first-ever set of bylaws for the department.*
- *Worked with university web team to redesign and reformat department web site, making it readily editable by faculty and staff.*
- *Restarted Department Newsletter after a several-year hiatus; resulted in positive feedback and increased contributions from alumni.*
- *Proposed, planned and initiated first post-commencement reception for all graduating students (Geology B.S., Environmental Geology B.S., Environmental Studies B.A., Geology M.S. and Ph.D.). This is now a well-attended, highly successful tradition in our department.*
- *Led recruitment and hiring of two new staff members (out of three total in our office) to replace internally-promoted administrator and academic secretary.*

Outreach

Media Interview, State Impact Pennsylvania (2021). Topic: *Study finds drilling wastewater not usually best option for road treatment*. (https://stateimpact.npr.org/pennsylvania/2021/08/30/penn-state-study-finds-drilling-wastewater-not-usually-best-option-for-road-treatment/)

Media interview, Allegheny Front (2018) *Topic: Radium in river sediments from oil and gas drilling waste* (https://www.alleghenyfront.org/study-conventional-drilling-waste-responsible-for-radioactivity-spike-in-rivers/)

Media interview, S&P Global Market Intelligence (2016) *Topic: Rare earth element resources in coal mine drainage* (http://www.snl.com/web/client?auth=inherit#news/article?id=38547112&cdid=A-38547112-12081)

Media interview, Midwest Energy News (2015) *Topic: Hydraulic fracturing flowback water* (http://midwestenergynews.com/2015/12/21/scientists-seek-more-data-on-existing-water-in-shale-formations/)

Media interview, 88.3FM WRCT-Pittsburgh (2013) *Topic: Origin of the Marcellus shale unconventional natural gas reservoir*

Media interview, National Public Radio (2012) *Topic: Evidence for long-term migration of brines from Marcellus Formation to shallow aquifers* <http://m.npr.org/news/front/156505748>

Participated in NSF-funded workshop at Duke University: Environmental and Social Implications of Hydraulic Fracturing and Gas Drilling in the United States. Discussed topic of *the strontium isotope fingerprint of Marcellus brines*.

Presentation at the Chemists Club Symposium, Pittsburgh Section, American Chemical Society (2007): *Astrobiological research at the University of Pittsburgh: What ancient soils tell us about the evolution of Earth's atmosphere*

K-6 Outreach - Presentations at Liberty Elementary School/International Studies Program, Pittsburgh (1999-2000)*: "Geology of the Western United States"(1999); "Geology of Eastern Canada" (1999); "Sierra Nevada Geology" (2000)*

STUDENT & POSTDOCTORAL ADVISING

Previous Postdoctoral Research Advisees:

Thai Phan (Ph.D. 2012, Environmental and Life Sciences, Trent University)
2/2012 - 11/2014 (University of Pittsburgh)
12/2014-2/2018 (ORISE/University of Pittsburgh: co-advised with J.A. Hakala and R.C. Capo)
Currently: Senior Geochemist, Stantec (Waterloo, Ontario, Canada)

Andrew Wall (Ph.D. 2011, Geosciences, Penn State University) ORISE Postdoc under supervision of J.A. Hakala, NETL; Co-advised with Hakala and R. Capo, University of Pittsburgh
7/2011 - 6/2014

Current Graduate Student Advisees:

Rebecca Matecha (B.S. Geosciences 2018, Smith College)
Dissertation Topic: Barium isotope systematics of deep brines and sedimentary barite
Co-advised with R.C. Capo

Camille Schaffer (B.S. Geology 2017, Allegheny College)
Dissertation Topic: Geochemical modeling of the long-term evolution of acidic coal mine drainage
Co-advised with R.C. Capo

Kristi Dobra (B.S. Geology 2011, Temple University; M.S. Soil and Water Science 2018, University of Florida)
Dissertation Topic: Freshwater mussels as bioindicators of metal sources
Co-advised with R.C. Capo

Tashane Boothe (B.S. Geology 2008; M.Phil. Geology 2021, University of the West Indies Mona)
Dissertation Topic: Recovery of critical metals and rare earth elements from acidic mine drainage
Co-advised with R.C. Capo

Current Graduate Student Committees:

Mary Braza (Ph.D.); Chloë Glover (Ph.D.); Tyler Leggett (Ph.D.)

Previous Graduate Student Advisees:

Zachary Tiemen, **M.S. 2017** (B.S. Atmospheric, Oceanic & Earth Sci., 2013, George Mason University)
Thesis Title: Isotopic fractionation of barium in shale and produced water from the Appalachian Basin, USA.
Currently: U.S. Army Corps of Engineers

Monica McGrath, **M.S. 2017** (B.S. Geology, 2013, Juniata College)

Thesis Title: Constraints on the petrogenesis of a Proterozoic talc deposit in southwestern Montana: A petrological and geochemical study.
Currently: Consulting Scientist, R.J. Lee Group, Inc.

Justin Mackey, **M.S. 2017** (B.S. Earth Science, 2012, Northeastern Illinois University)
Thesis Title: A chemostratigraphic study of regional and global controls on deposition and preservation of Late Cambrian shales and carbonates of the Conasauga Group, Appalachian Basin, USA.
Currently: Research Scientist, National Energy Technology Laboratory

Amy Wolfe, **Ph.D. 2010** (B.S. Marine Science, 2002, University of South Carolina)
Thesis Title: Oxidative dissolution of pyrite: A combined experimental and iron isotope investigation.
Currently: Geologist IV, Kentucky Geological Survey

Tonya Brubaker, **M.S. 2010** (B.S. Geology, 2007, University of Pittsburgh)
Thesis Title: Strontium isotope systematics of coal utilization byproducts and their interactions with environmental waters

Lev Spivak-Birndorf, **M.S. 2007** (B.A. Environmental Studies, 2004, University of Chicago)
Thesis Title: Strontium isotope systematics and geochemistry of coal utilization by-products.
Currently: PSI Labs, Ann Arbor, Michigan

Barbara Hamel, **M.S. 2005** (B.S. Environmental Science, 1993, Slippery Rock University)
Thesis Title: Tracing interaction of acid mine drainage and coal combustion byproducts in a grouted coal mine: Application of strontium isotopes.
Currently: Project Manager, Moody and Associates Inc., New York

Katherine Walden (now Schmid), **M.S. 2005** (B.S. Geology, 2001, Ohio State University)
Thesis Title: Neodymium and strontium isotope investigation of the Precambrian Kalkkloof paleosol, South Africa.
Currently: Geologist, Pennsylvania Department of Conservation and Natural Resources - Geological Survey

Ann Kim, **Ph.D. 2002** (M.S. Geology, 1972, University of Pittsburgh)
Dissertation Title: Fluid extraction of metals from coal fly ash: Geochemical simulation of natural leaching.
Currently: Research Scientist, National Energy Technology Lab, Pittsburgh (retired)

Steven J. Schatzel, **Ph.D. 2001** (M.S. Geology, 1990, University of Pittsburgh)
Dissertation Title: Tracking the provenance, transport, and redistribution of coal mineral matter using neodymium isotopes
Currently: Research Scientist, NIOSH Pittsburgh

Joseph Minervini, **M.S. 2001** (B.S. Soil Science, 1999, Cal Poly State University)
Thesis Title: Radiogenic isotope investigation of sources, transport, and deposition of rare earth elements in the Owens Lake drainage basin, eastern California.
Currently: Research Scientist, ExxonMobil Exploration Company

Victoria A. Pretti, **M.S. 2000** (B.S. Geological Sciences, 1997, Lehigh University)
Thesis Title: Geochemical and isotopic characterization of streamwaters feeding the Owens River System, California.
Currently: Director and Quality Assurance Officer, New York State Department of Health

Mary Lynn Hronakes-Yurko, **M.S. 1999** (B.S. Microbiology, 1988, Penn State University)
Thesis Title: Strontium isotopic and major and trace element composition of freshwater mussel shells as a record of water chemistry: French Creek watershed, PA, 1897-1998.

Previous Graduate Student Committees:

Ian Flynn (Ph.D., 2022); Deborah Neidich (Ph.D., Anthropology, 2021); Benjamin Hedin (Ph.D., 2021); Suryodoy Goshal (Ph.D., 2021); Victoria Buford Parks (Ph.D., 2020); James Thompson (Ph.D., 2020); Christine Simurda (Ph.D., 2019); Daniel Williams (Ph.D. 2018); Zhongjie Yu (Ph.D. 2018); Irene Wallrich (M.S. 2017); Melissa Griffore (M.S. 2017); Erich Zorn (Ph.D. 2016); Richard Spaulding (M.S. 2015); Matthew Dieterich (M.S. 2015); Samantha Pfister (M.S. 2015); Aubrey Hillman (Ph.D. 2015); David Pompeani (Ph.D. 2015); Bobak Karimi (Ph.D. 2014); Michelle Gilmore (M.S. 2014); Lucy rose (Ph.D. 2014); Courtney Kohl (M.S. 2014); James Gardiner (Ph.D. 2013); David Felix (Ph.D. 2012); Kaitlin Clark (M.S. 2012); Dayna Quick (Ph.D. 2012, University of California at Santa Barbara); Christopher Purcell (Ph.D. 2012); Elizabeth Chapman (Ph.D. 2011); Rachel Lee (Ph.D. 2011); Sarah Morealli (M.S. 2010); Broxton Bird (Ph.D. 2009); Sherry Stafford (Ph.D. 2007);

Ran Liu (Ph.D. 2006, Carnegie Mellon University); Daniel Nelson (M.S. 2004); Jeffrey Byrnes (Ph.D. 2002); Melanie Hellman (M.S. 2002); Elizabeth Bryant (M.S. 2002); Amanda Reynolds (M.S. 2001); Timothy Pierce (M.S. 2001); William Winters (M.S. 2000); Sherry Stafford (M.S. 1999); Henry Prellwitz (Ph.D. 1998); Theodore Weaver (M.S. 1998); Gregory Ayres (M.S. 1997)

Undergraduate Research:

Will Heck (B.S., Geology, 2020) *Barium isotope investigation of barium sources and barite precipitation during simulated hydraulic fracturing of Marcellus Shale core*

Jesse McGunnigle (B.S., Geology, 2019) *Rb-Sr and petrographic analysis of magmatic and post-magmatic alteration in the Stillwater Igneous Complex*

Corinne Hite (B.S., Geology, 2018) *Strontium isotope analysis of changing solute sources to Searles Lake, eastern California*

William Burger (B.S., Geology, 2015) *Lithium sources to Owens Lake, eastern California: Relative rates of hydrothermal vs. weathering release*

Kelly Flannery (B.S., Geology, 2013; co-advised with R.C. Capo and A.J. Wall) *Iron isotope variations during oxidative dissolution of arsenopyrite*

Timothy Gallagher (B.S. and B.Phil., Geology, 2010; co-advised with R.C. Capo) *Origin of Jurassic carbonate nodules in southeastern Wyoming (Honors Thesis)*

Justin Hynicka (B.S. and B.Phil., Geology, 2008) *Strontium isotope tracking of cation sources in arid soils from the southern Atacama Desert, Chile (Honors Thesis)*

John Boulanger (B.S., Environmental Geology, 2001) *Isotopic study of water and sediment sources in the Death Valley and Panamint Valley regions, California*

Brian Green (B.A., Environmental Studies, 2001) *Tracking sea turtle migration using isotope geochemistry of shell phosphate*

Michael Speerschneider (B.A., Environmental Studies/B.S. Physics, 1999) *Experimental study of elemental fractionation during laser ablation analysis and application to in situ planetary instruments*

Robin Dee (B.S., Environmental Geology, 1998) *Geochemical interactions between water and shale: Implications for acid mine drainage*

Undergraduate Workers Supported from Grants:

Robin Dee, Michael Speerschneider, John Boulanger, Brian Green, Richard Kilpatrick, Jenny Lee, Zachary Zrimsek, Chad Lupp, Andrea Glassmire, Alyssa Lyons, Patrick Milham, Erin Minster, Jesse Kelly, Karen Kracker, Janelle Shelatz, Erich Zorn, Jeffrey Patterson, Amanda Illar, Andrew Stiff, Valerie Costigan, Lacey Kreiensieck, Max Gruin, Amber Hanna, Tonya Brubaker, James Gardiner, Allie Ackerman, Justin Hynicka, Megan Achille, Kelly Flannery, Katherine Roll, Emily Burt, William Burger, Miranda DiFonso, Elisabeth Mahoney, Anna Thornton, Corinne Kuebler, Corinne Hite, Emily Dobies, Julia Rudy, Kevin Love, William Heck, Grace Bair, Jack McGuane, Nathan Schollaert

TEACHING EXPERIENCE

Undergraduate courses taught:

GEOL 0800: *Geology (3 credits)*

General introduction to geology for non-majors and majors with no previous geology course (typical enrollment 150-250); covers all fields of geology, emphasizing the major geodynamic processes that shape the Earth's surface and interior, and the coevolution of life and the Earth's surface/ocean/atmosphere. One hour of recitation each week designed to give students hands-on activities in small groups with teaching assistants.
AY 1998, 1999, 2001, 2002, 2004(x2), 2005, 2009, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2023

GEOL 0860: *Environmental Geology (3 credits)*

General introduction to geology for non-majors and majors with no previous geology course, with a focus on environmental issues and impact of geologic processes on human populations. One hour of recitation each week designed to give students hands-on activities in small groups with teaching assistants.
AY 1996 (50%)

GEOL 1001: *Mineralogy (4 credits)*
Introduction to mineral structures, chemistry, petrogenesis, and analytical techniques (including optical microscopy); includes material formerly taught in GEOL 1002 (below) after the courses were merged in 1999. Intensive laboratory section (with teaching assistant) introduces students to identification of minerals and interpretation of micro- and macroscopic structures using the petrographic microscope.
AY 2005, 2007, 2008, 2009, 2010, 2012, 2014, 2015, 2016

GEOL 1002: *Optical Mineralogy (4 credits)*
Introduction to optical theory with application to petrographic analysis of thin sections for Geology majors. Intensive laboratory section (with teaching assistant) introduces students to identification of minerals and interpretation of micro- and macroscopic structures using the petrographic microscope.
AY 1996

GEOL 1003: *Igneous and Metamorphic Petrology (4 credits)*
Petrogenesis of igneous and metamorphic rocks for Geology majors; overview of theory and tectonic environment for the major igneous/metamorphic rock types; phase diagrams, fractional crystallization, partial melting, mineral reactions. Intensive laboratory section (with teaching assistant) on interpretation of hand samples and this sections using the petrographic microscope.
AY 2002, 2017, 2018, 2019, 2020, 2021, 2022

GEOL 1500-W: *Chemistry of the Earth and its Environment (3 credits)*
Overview of geochemical processes for junior-senior level Environmental Studies majors; geochemical "building blocks" of the Earth, and chemical interactions between humans and the environment; multiple student research papers fulfill writing requirement (>24 pages per student, multiple revisions). No teaching assistant.
AY 1997, 1998, 1999

Graduate courses taught:

GEOL 2502/3953: *Advanced Analytical Geochemistry (3 credits)*
Basics of analytical inorganic geochemistry, with an emphasis on elemental analysis of geological and environmental samples by inductively-coupled plasma atomic emission spectroscopy (ICP-AES) and isotopic ratio measurement by thermal ionization mass spectrometry (TIMS). In addition to lectures, students carried out independent research projects using the above instrumentation, and presented the results of their research in oral and written form.
AY 1999 (50%), 2001 (50%)

GEOL 2520: *Radiogenic Isotope Geology and Geochronology (3 credits)*
Fundamentals of isotope geology including nucleosynthesis, geochronology, and the use of radiogenic and stable isotopes as tracers for a variety of geological, biological, planetary, and environmental systems. Student homework problem sets, term papers, and oral presentations.
AY 1996 (50%), 1998, 2001, 2004, 2006, 2008, 2010, 2012, 2014, 2016, 2018, 2020

GEOL 2740: *Planetary Geochemistry (3 credits)*
Geochemical evolution of the solar system, including nucleosynthesis, planetary accretion and differentiation, formation of Earth's moon, and continuing geochemical processes on the terrestrial planets. Overview of models for planetary geochemical evolution using the meteorite record, lunar sample chemistry, and data from planetary surface probes. Student homework problem sets, term papers, and oral presentations.
AY 2000, 2005

GEOL 3906/3908/3953: *Astrobiology Seminar (1-3 credits)*
Overview of the current state of research in astrobiology, with a focus on the history of Earth's atmosphere and the early evolution of life; combination of lectures, readings, student-led discussions, and videoconferencing with astrobiology researchers at The Pennsylvania State University.
AY 2002 (50%), 2006 (50%), 2007 (50%)

GEOL 3906: *Topics in Geology: Applications of Metal Stable Isotope Systems* (2 credits)
Introduction to the systematics of metal stable isotopes (e.g., Li, U, Fe, Mo, Cu, Mg, Ca), including mass-dependent and -independent fractionation, chemical methods and mass spectrometry. Application of isotope systems to geological and biological systems. Combination of lectures, readings, and student-led discussions
AY 2015

GEOL 3908: *Topics in Geology: Quaternary History of Owens Valley, CA* (3 credits)
Overview of the volcanic, hydrologic and geomorphological evolution of Owens Valley, California. Combination of lectures, readings, and student-led discussions; one week field trip to Nevada and California during term
AY 2007 (50%)

GEOL 3952/3960: *Topics in Geochemistry: Application of Trace Element and Isotope Systems (2-3 credits)*
Discussion course focused on novel uses of geochemical tracers (primarily trace elements and isotope systems) in geologic, hydrologic, pedologic, and/or biologic systems; application of these tools to problems in economic geology and low-temperature/environmental geochemistry. Weekly readings and student-led discussions.
AY 1996 (50%), 1997 (50%)

GEOL 3953: *Topics in Geochemistry: Evolution of the Atmosphere (3 credits)*
Focus on variations in atmospheric oxygen and carbon dioxide on Earth from the earliest Precambrian to the Phanerozoic, as preserved in paleosols and marine and terrestrial sediments; comparison of the geologic record of atmospheric chemistry with theoretical models for atmospheric evolution, possible implications for atmospheric chemistry and the evolution of life on other planets. Combination of lectures, readings, and student-led discussions.
AY 2000 (50%)

GEOL 3953: *Topics in Geochemistry: Appalachian Shale Gas Resources (3 credits)*
Geochemical aspects of oil and gas extraction and environmental impacts in the Appalachian Basin. Explored topics including exploration and extraction of unconventional resources; hydraulic fracturing and its environmental impacts; isotopic studies of water and gas migration. Combination of lectures, guest lectures from experts from industry and academia, readings, and student-led discussions.
AY 2013 (50%)

GEOL 3975: *Topics in Volcanology: Volcanism in the Western U.S. (2 credits)*
Origin and evolution of volcanic provinces in the western United States; geochemical evolution of magmas, eruption mechanisms, physiography of volcanic deposits. Combination of lectures, readings, and student-led discussions.
AY 1996 (50%)