CURRICULUM VITAE

(updated March, 2016)

CONTACT INFORMATION

U.S. Geological Survey
California Water Science Center
6000 J Street, Placer Hall
Sacramento, CA 95819-6129
phone: 916-278-3134
fax: 916-278-3013
e-mail: cnalpers@usgs.gov

EDUCATION

University of California, Berkeley (9/81 – 8/86)
M.A. in Geology, December, 1983
Ph.D. in Geology, December, 1986
Ph.D. dissertation: "Geochemical and Geomorphological Dynamics of Supergene Copper Sulfide Ore Formation and Preservation at La Escondida, Antofagasta, Chile"

Harvard University (9/75 – 6/77 and 9/78 – 6/80)
A.B., Magna cum Laude, in Geological Sciences, June, 1980
Senior honors thesis: "Mineralogy, Paragenesis, and Zoning of the Luz Vein, Uchucchacua District, central Peru"

WORK EXPERIENCE

Research Chemist, GS-14 (9/94 – present)
Research Chemist, GS-13 (9/91 – 9/94)
U.S. Geological Survey, Water Mission Area, California Water Science Center (formerly California District Office), Sacramento, California

Chief scientist on projects related to the environmental geochemistry of mineral deposits and the fate and transport of trace metals in groundwater and surface water. Past work has included studies of acid mine drainage, sulfate minerals, and trace-metal fate and transport in groundwater at Penn Mine, in underground mine workings at the Iron Mountain mine and Copper Bluff mine, CA, and in surface water and contaminated sediment in Keswick Reservoir and the Sacramento River. Current research includes multi-disciplinary investigations of: (1) mercury contamination and bioaccumulation associated with historical gold mining in the Sierra Nevada and Trinity Mountains, CA, mercury mining in the Coast Ranges, CA, and in wetlands and historical peat deposits of the Sacramento River watershed, the Sacramento–San Joaquin Delta, the Yolo Bypass, and the Cache Creek Settling Basin; (2) arsenic mineralogy and bioavailability in mine wastes in the Sierra Nevada; and (3) iron-rich pipe scale at Iron Mountain. As project chief of several large, multi-disciplinary projects, is actively involved with outreach and coordination with stakeholder groups including federal, state, and local agencies as well as non-profit organizations. Serves on several technical advisory committees and acts as coordinator between the USGS and California State University Sacramento science and engineering departments. For CALFED and the California Bay-Delta Authority, has led a team of mercury experts in constructing a peer-reviewed Mercury Conceptual Model for the Sacramento–San Joaquin Delta, and has worked with others on applying this model and other conceptual models to assess potential ecosystem restoration actions.

WORK EXPERIENCE (cont.)

Assistant Professor (1/90 – 9/91)
Department of Geological Sciences
McGill University, Montréal, Québec, Canada
Taught courses in Environmental Geology, Geochemical Modeling, and Hydrogeochemistry of Contaminated Sites.

Chemist, GS-12 (9/89 – 12/89)
U.S. Geological Survey, Water Resources Division
Menlo Park, California

Post-doctoral Research Associate (NRC Fellow) (9/87 – 8/89)
Research Advisor - D.K. Nordstrom
U.S. Geological Survey, Water Resources Division
Menlo Park, California

Visiting Assistant Professor (9/86 – 8/87)
Dept. of Geological Sciences
University of Michigan, Ann Arbor

Teaching Assistant (8/83 – 12/83 and 1/86 – 5/86)
for Professors H.C. Helgeson and W.E. Dietrich
Dept. of Geology and Geophysics
University of California, Berkeley

Research Assistant (6/82 – 8/83 and 1/84 – 12/85)
Research Advisor - Prof. G. Brimhall
Dept. of Geology and Geophysics
University of California, Berkeley

Exploration Geologist (6/80 – 6/81)
ASARCO, Inc.
Tucson, Arizona

Research Associate (1/78 – 8/78)
Energy and Environmental Analysis, Inc.
Arlington, Virginia

Roughneck (10/77 – 11/77)
Signal Drilling Co.
Rock Springs, Wyoming

ACADEMIC AFFILIATIONS

- Adjunct Professor, California State University, Sacramento, Geology Dept., 2006 – present
- Research Associate, Univ. of California, Davis, Dept. of Geology, 2001 – present

GRADUATE STUDENTS ADVISED / THESIS COMMITTEES

Doctoral Students

1. Dold, Bernhard, 1999, "Mineralogical and geochemical changes of copper flotation tailings in relation to their original composition and climatic setting — Implications for acid mine drainage and element mobility." Ph.D. thesis, University of Geneva, Switzerland. (external examiner; primary advisor Prof. Lluis Fontboté)

2. Parsons, Michael, 2001, "Geochemical and mineralogical controls on trace element release from base-metal smelter slags." Ph.D. thesis, Dept. of Geology, Stanford University, Stanford, CA, 307 p. (committee member; primary advisor Prof. Dennis Bird)

3. Sobron, Pablo, 2008, "Raman spectroscopy of sulfate efflorescences from Iron Mountain Superfund Site, California." Ph.D. thesis, Centro de Astrobiología, Facultad de Ciencias, Universidad de Valladolid, Spain. (external examiner; primary advisor Prof. Fernando Ruhl)

4. Gibson, Blair D., 2011, "Integrated methods for characterizing the passive treatment of mercury and selenium in groundwater and sediment." Ph.D. thesis, Dept. of Earth and Environmental Sciences, University of Waterloo, Ontario, Canada. (external examiner; primary advisor Prof. Carol Ptacek)

5. DeSisto, Stephanie, 2014, "Hydrogeochemical evaluation and impact of remediation design on arsenic mobility at historical gold mine sites." Ph.D. thesis, Dept. of Geological Sciences and Geological Engineering, Queen's University, Kingston, Ontario, Canada. (external examiner; primary advisor Prof. Heather Jamieson)

6. Williams, Amy J., 2014, "Geobiology of acid-saline systems: implications for early martian habitats," Dept. of Geology, Univ. of California, Davis, California. (committee member; primary advisor Prof. Dawn Sumner)

Master's Students

1. Rogers, Teresa M., 1996, "Bacterial diversity in acid mine drainage from Iron Mountain, Shasta County, California: a 16S ribosomal DNA approach." M.Sc. thesis, University of Wisconsin, Madison, WI. (committee member; primary advisor Prof. Jillian Banfield)

2. Robinson, Clare, 1999, "The role of jarosite and copiapite in the chemical evolution of acid drainage waters, Richmond Mine, Iron Mountain, California." M.Sc. thesis, Dept. of Geological Sciences and Geological Engineering, Queen's University, Kingston, Ontario, Canada, 206 p. (committee member; primary advisor Prof. Heather Jamieson)

3. Shipp, William G., 2001, "Determination of acid mine drainage using lake sediment porefluid geochemistry: Sulphur Bank Mercury Mine, Clear Lake Oaks, California." M.Sc. thesis, Dept. of Geology, University of California, Davis, CA, 129 p. (committee member; primary advisor Prof. Robert Zierenberg)

4. Bambic, Dustin, 2004, "Hydrobiogeochemical cycling of copper and zinc near an AMD-affected stream." M.Sc. thesis, Dept. of Land, Air, and Water Resources, University of California, Davis, CA. (committee member; primary advisor Prof. Wendy Silk)

5. Phillippe, Jeanne, 2005, "Geochemical constraints on Herman Pit: Sulphur Bank Mercury Mine, US EPA Superfund Site." M.Sc. thesis, Dept. of Geology, University of California, Davis, CA. (committee

member; primary advisor Prof. Robert Zierenberg)

6. Livingston, James, 2007, "The paragenesis of metal sulfate minerals in acid mine drainage environments and the synthesis of magnesiocopiapite." M.Sc. thesis, Dept. of Geology, California State University, Chico, CA, 174 p. (committee member; primary advisor Prof. William Murphy)

7. Tangalos, George, 2008, "Fe isotope fractionation by microbial iron reduction in a modern banded iron formation analog." M.Sc. thesis, Department of Geoscience, University of Wisconsin, Madison, WI. (committee member; primary advisor Prof. Eric Roden)

8. Burlak, Tamsen, 2012, "Geochemistry of iron- and arsenic-bearing minerals in soil and bedrock associated with gold-quartz vein mineralization at Empire Mine State Historic Park, Nevada County, California." M.Sc. thesis, Department of Geology, California State University, Sacramento, CA. (primary advisor)
http://csus-dspace.calstate.edu/handle/10211.9/1885

9. Stumpner, Elizabeth, 2014, "Development of best practices for preservation of reactive mercury(II) in sediment samples from three areas in northern California." M.Sc. thesis, Department of Geology, California State University, Sacramento, CA. (committee member; primary advisor Dr. Mark Marvin-DiPasquale) http://csus-dspace.calstate.edu/handle/10211.3/123075

10. Flower, Christopher, 2014, "Groundwater and soil geochemistry variation and correlation in the vicinity of Bakersfield, California." M.Sc. thesis, Department of Geology, California State University, Sacramento, CA. (primary advisor) http://csus-dspace.calstate.edu/handle/10211.3/131642

11. Haight, Erica M., 2014, "Spatial variation and correlation in groundwater and soil geochemistry in the southeast San Joaquin Valley, in the vicinity of Fresno, California." M.Sc. thesis, Department of Geology, California State University, Sacramento, CA. (primary advisor) http://csus-dspace.calstate.edu/handle/10211.3/131644

12. Siegel, Emily S., 2014, "A statistical approach to understanding influences on groundwater chemistry in California's central coast." M.Sc. thesis, Department of Geology, California State University, Sacramento, CA. (committee member; primary advisor Dr. Joseph Domagalski) http://csus-dspace.calstate.edu/handle/10211.3/131571

13. Sparks, Genevieve (in progress, expected 2016), "Mercury and methylmercury loads in three tributaries to Lake Berryessa, upper Putah Creek watershed, California." M.Sc. thesis, Department of Geology, California State University, Sacramento, CA. (committee member; primary advisor Prof. Timothy Horner)

14. Hedgpeth, Michael (in progress, expected 2017), "Mineralogical and geochemical variations in floodplain sediment from the Cache Creek Settling Basin, Yolo County, California." M.Sc. thesis, Department of Geology, California State University, Sacramento, CA. (committee member; primary advisor Prof. Kevin Cornwell)

15. Ward, Alfred John (in progress, expected 2016-17) "Mineralogical and geochemical fingerprinting of sediment sources at Malakoff Diggins State Historic Park, California." M.Sc. thesis, Department of Geology, California State University, Chico, CA. (committee member; primary advisor Prof. Carrie Monohan)

PROFESSIONAL AND ACADEMIC HONORS AND RESPONSIBILITIES

- Co-organized theme sessions (oral and poster) on "Importance of redox processes in biogeochemistry" for 2015 Goldschmidt Meeting, Prague, Czech Republic, August 2015
- Member of Executive Organizing Committee, 2014 Goldschmidt Meeting, Sacramento, CA, June 2014, for The Geochemical Society
- Co-organized theme sessions (oral and poster) on "Biogeochemistry, bioaccumulation, bioavailability, and bioaccessibility of trace metals and metalloids in aquatic and terrestrial systems" (44 oral and 54 poster presentations) for 2014 Goldschmidt Meeting, Sacramento, CA, June 2014.
- Co-organized and co-chaired topical sessions (oral and poster) on "Celebrating the scientific contributions of Kirk Nordstrom – Part 1: Acid to neutral mine drainage, geochemistry of iron and sulfur, sulfate minerals, natural background, and geochemical modeling and Part 2: Geochemistry of arsenic and antimony, microbial biogeochemistry, geothermal systems, radioactive waste disposal, and geochemical modeling," 2013 annual meeting of the Geological Society of America, Denver, CO, Oct. 2013.
- Received Sierra Crest Award for being a "visionary leader helping communities reclaim the Sierra," at "Reclaiming the Sierra: Community Summit on Mining Impacts," The Sierra Fund, Nevada City, CA, Nov. 2010.
- Co-organized and co-chaired topical sessions (oral and poster) on "Vapors, Brines, Sulfides, and Mines: Understanding Metal Mobility in Magma-Hydrothermal Systems and their Supergene Successors" at Annual Meeting of the Geological Society of America, Denver, CO, Oct. 2010.
- Co-organized and co-chaired special session (poster) on "Peat Soils: Natural Archives of Information on Sea Level Rise, Landscape Evolution, and Anthropogenic Disturbance" at Fall Meeting of American Geophysical Union, San Francisco, CA, Dec. 2008
- Alpersite, a new mineral, approved by the International Commission on New Mineral Names, October 2003 [*see* Peterson, R.C., Hammarstrom, J.M., and Seal, R.R., II, 2006, Alpersite (Mg, Cu)$SO_4 \cdot 7H_2O$, a new mineral of the melanterite group, and cuprian pentahydrite: Their occurrence within mine waste: American Mineralogist, v. 91, p. 261–269.]
- Co-organized and co-chaired topical sessions (oral and poster) on "Sulfate Minerals in High- and Low-Temperature Environments: A tribute to Robert O. Rye," Annual Meeting of the Geological Society of America, Reno, NV, November 2000
- Co-organized short course on "Sulfate Minerals: Crystallography, Geochemistry, and Environmental Significance", co-sponsored by the Mineralogical Society of America and The Geochemical Society, Tahoe City, CA, November 2000
- Associate Editor, Economic Geology, 1999–2003
- Co-organized and/or co-chaired four special sessions on historical mining at Centennial Meeting of the Cordilleran Section of the Geological Society of America, Berkeley, CA, June 1999
- Editor's Citation for Excellence in Manuscript Review, Journal of Environmental Quality, 1997
- Co-organized special sessions on "Environmental Chemistry of Sulfide Oxidation" at Annual Meeting of the American Chemical Society, Washington, D.C., August 1993
- Post-doctoral Resident Research Associate, National Academy of Sciences/National Research Council, U.S. Geological Survey, 1987–89
- Evan Just Award, San Francisco Section of the American Institute of Mining Engineering, 1986
- W.W. van Arsdale Fellow, University of California, Berkeley, 1981–82
- Dean's List, Harvard College, 1975–76, 1976–77, 1978–79, 1979–80

TECHNICAL ADVISORY PANELS

1987–present Technical Advisory Committee, Iron Mountain Mine Superfund Site, for U.S. Environmental Protection Agency, Region 9, San Francisco, CA

2003–present Technical Advisory Committee, Sulphur Bank Mercury Mine Superfund Site, for U.S. Environmental Protection Agency, Region 9, San Francisco, CA

2011–present Technical Advisory Committee, Leviathan Mine (CA) Superfund Site, for U.S. Environmental Protection Agency, Region 9, San Francisco, CA

2011–2012 Technical Advisory Committee, Cordero Mine (NV) Superfund Site, for U.S. Environmental Protection Agency, Region 9, San Francisco, CA

2009–2011 Technical Advisory Committee, Comins Lake (NV) Superfund Site, for U.S. Environmental Protection Agency, Region 9, San Francisco, CA

2007–2009 Science Review Panel, Questa Rock Pile Stability and Weathering Study, for Acid Drainage Technology Initiative (ADTI) and Chevron Minerals, Inc. (formerly Molycorp), Questa, NM

2006–2008 Leader of Mercury Team, CALFED Delta Regional Ecosystem Restoration Implementation Plan (DRERIP).

2006–2007 Agency Science Advisory Panel, Sierra Mining Toxics Initiative, Sierra Fund, Nevada City, CA

2004–2007 Review Panel, Copper Water-Effect Ratio (WER) Study for the Los Angeles River, for City of Los Angeles, CA and City of Burbank, CA

2004–2005 Review Panel, Questa Baseline and Pre-Mining Ground-Water Quality Investigation, Questa, NM, for U.S Geological Survey, Boulder, CO

2003–2004 Review Panel, Project on “Co-production of Silica from Geothermal Fluids” by Lawrence Livermore National Laboratory, for California Energy Commission, Sacramento, CA

1997–2002 Technical Advisory Committee, Penn Mine Long-Term Remediation, for Central Valley Regional Water Resources Control Board, Rancho Cordova, CA, and East Bay Municipal Utility District, Oakland, CA

STEERING COMMITTEES, TEAMS AND COUNCILS

2014-present Co-chair, Water Day, an outreach event to be co-hosted by the U.S. Geological Survey and Sacramento State (annual event planned to start April, 2017)

2007–2014 CELP (California Environmental Legacy Project) Steering Committee

2012-2013 Co-chair, Science and Engineering Exposition on Water (SEEwater 2013), an outreach event to be co-hosted by the U.S. Geological Survey and Sacramento State (planned for April, 2013 but cancelled because of federal government sequester)

2008–2011 U.S. Geological Survey California Water Science Center Diversity Team (ex officio member)

2007–2009 U.S. Geological Survey Diversity Council

2006–2009 STEM (Science, Technology, Engineering, and Mathematics) Steering Committee, California State University Sacramento

1992–1994 U.S. Geological Survey Strategic Planning Team

MANUSCRIPT REVIEWS

Colleague reviews have been completed since 2001 for the following peer-reviewed journals:

American Mineralogist
Applied Geochemistry
Chemical Geology
Ecological Applications
Economic Geology
Environmental Health Perspectives
Environmental Science & Technology
Geochimica et Cosmochimica Acta
Journal of Environmental Quality
Journal of South American Geology
Nevada Water Resources Association Journal
Science of the Total Environment

In addition, several peer reviews have been completed for USGS reports and journal articles by USGS authors prior to journal submission.

REVIEWS OF PROPOSALS AND TECHNICAL DOCUMENTS

Reviews of proposals and technical reports have been completed since 2001 for the following institutions:

American Chemical Society, Petroleum Research Fund
California Department of Fish and Game
California Water Resources Center
CALFED (California Bay-Delta Authority)
FONDECYT's Study Group of the Earth Science (Government of Chile)
Hudson River Foundation
National Aeronautics and Space Administration (NASA) — Mars Fundamental Research
National Science Foundation (NSF)
National Science and Engineering Research Council of Canada (NSERC)
Swiss National Science Foundation (SNSF)
U.S. Geological Survey

PEER-REVIEWED PUBLICATIONS, THESES, AND CONFERENCE PROCEEDINGS

1980

1. Alpers, C.N., 1980, *Mineralogy, Paragenesis, and Zoning of the Luz Vein, Uchucchacua District, Central Peru*: Senior honors thesis, Harvard University, Cambridge, MA, 138 p.

1985

2. Brimhall, G.H, Alpers, C.N., and Cunningham, A.B., 1985, Analysis of supergene ore-forming processes and ground-water solute transport using mass balance principles: *Economic Geology*, v. 80, p. 1227–1256. (30% of analysis, 30% of manuscript preparation)

1986

3. Alpers, C.N., 1986, *Geochemical and Geomorphological Dynamics of Supergene Copper Sulfide Ore Formation and Preservation at La Escondida, Antofagasta, Chile*: Ph.D. dissertation, University of California, Berkeley, CA, 220 p.

1987

4. Stoffregen, R.E. and Alpers, C.N., 1987, Woodhouseite and svanbergite in hydrothermal ore deposits: Products of apatite destruction during advanced argillic alteration: *Canadian Mineralogist*, v. 45, p. 201–211. (30% of laboratory data, 50% in data interpretation, 40% of manuscript preparation)

1988

5. Alpers, C.N., and Brimhall, G.H, 1988, Middle Miocene climatic change in the Atacama Desert, northern Chile: Evidence from supergene mineralization at La Escondida: Geological Society of America Bulletin, v. 100, p. 1640–1646. (100% of field sampling, 80% of data interpretation, 90% of manuscript preparation)

1989

6. Alpers, C.N., and Brimhall, G.H, 1989, Paleohydrologic evolution and geochemical dynamics of cumulative supergene metal enrichment at La Escondida, Atacama Desert, northern Chile: *Economic Geology*, v. 84, p. 229–255. (100% of field sampling, 80% of data interpretation, 90% of manuscript preparation)

7. Alpers, C.N., Nordstrom, D.K., and Ball, J.W., 1989, Solubility of jarosite solid solutions precipitated from acid mine waters, Iron Mountain, California, U.S.A.: *Sciences Géologiques, Bulletin*, v. 42, p. 281–298. (90% of laboratory analyses, 80% of data interpretation, 90% of manuscript preparation)

1990

8. Alpers, C.N., and Nordstrom, D.K., 1990, Stoichiometry of mineral reactions from mass balance computations for acid mine waters, Iron Mountain, California, in *Acid Mine Drainage—Designing for Closure*, J.W. Gadsby, J.A. Mallick, S.J. Day, eds., Bi-Tech Pub. Ltd.: Vancouver, British Columbia, Canada, p. 23–33. (80% of geochemical modeling, 80% of manuscript preparation)

9. Alpers, C.N., and Whittemore, D.O., 1990, Hydrogeochemistry and stable isotopes of ground and surface waters from two adjacent closed basins, Atacama Desert, northern Chile: *Applied Geochemistry*, v. 5, p. 719–734. (100% of field sampling, 60% of laboratory analyses, 80% of manuscript preparation)

10. Alpers, C.N., Dettman, D., Lohmann, K.C., and Brabec, D., 1990a, Stable isotopes of carbon dioxide in soil gas over massive sulfide mineralization at Crandon, Wisconsin: *Journal of Geochemical*

Exploration, v. 38, p. 69–86. (100% of field work, 20% of laboratory analyses, 60% of data interpretation, 80% of manuscript preparation)

11. Bussell, M.A., Alpers, C.N., Petersen, U., Shepherd, T.J., Bermudez, C., and Baxter, A.N., 1990, The Ag-Pb-Zn-Mn skarn, vein, and replacement deposits at Uchucchacua, Peru: studies of structure, mineralogy, metal zoning, Sr isotopes, and fluid inclusions: *Economic Geology*, v. 85, p. 1348–1383. (30% of manuscript preparation, wrote sections on mineralogy and metal zoning)

12. Nordstrom, D.K., Burchard, J.M., and Alpers, C.N., 1990, The production and variability of acid mine drainage at Iron, Mountain, California: A Superfund site undergoing rehabilitation, in *Acid Mine Drainage—Designing for Closure*, J.W. Gadsby, J.A. Mallick, S.J. Day, eds., Bi-Tech Pub. Ltd.: Vancouver, British Columbia, Canada, p. 13–21. (20% of manuscript preparation)

1991

13. Alpers, C.N., and Nordstrom, D.K., 1991, Evolution of extremely acid mine waters at Iron Mountain, California: Are there any lower limits to pH?, in *Proceedings, Second International Conference on the Abatement of Acidic Drainage*, Montréal, Québec, Canada, September 16-18, 1991, MEND (Mine Environment Neutral Drainage): Ottawa, Canada, v. 2, p. 321–342. (80% of geochemical modeling, 90% of manuscript preparation)

1992

14. Alpers, C.N., Nordstrom, D.K., and Burchard, J.M., 1992a, *Compilation and interpretation of water-quality and discharge data for acidic mine waters at Iron Mountain, Shasta County, California, 1940-91*. U.S. Geological Survey Water-Resources Investigations Report 91-4160, 173 p. (50% of data compilation, 70% of manuscript preparation)

15. Alpers, C.N., Rye, R.O., Nordstrom, D.K., White, L.D., and King, Bi-Shia, 1992b, Chemical, crystallographic, and isotopic properties of alunite and jarosite from acid hypersaline Australian lakes: *Chemical Geology*, v. 96, p. 203–226. (60% of laboratory analyses, 80% of manuscript preparation)

16. Stoffregen, R.E. and Alpers, C.N., 1992, Observations on the cell dimensions, water contents and δD of natural and synthetic alunite: *American Mineralogist*, v. 77, p. 1092–1098. (50% of data interpretation, 30% of manuscript preparation)

1993

17. Alpers, C.N., and Blowes, D.W. (eds.), 1993a, *Environmental Geochemistry of Sulfide Oxidation*. ACS Symposium Series, v. 550, American Chemical Society: Washington D.C., 681 p. (60% of editing)

18. Alpers, C.N., and Blowes, D.W., 1993b, Preface: In *Environmental Geochemistry of Sulfide Oxidation*, Alpers, C.N., and Blowes, D.W. (eds.), ACS Symposium Series, v. 550, American Chemical Society: Washington D.C., p. xii-xiv. (60% of manuscript preparation)

19. Alpers, C.N., Nordstrom, D.K., and Thompson, J.M., 1993, Seasonal variations in the Zn/Cu ratio of acid mine drainage from Iron Mountain, California: In *Environmental Geochemistry of Sulfide Oxidation*, Alpers, C.N., and Blowes, D.W. (eds.) ACS Symposium Series, v. 550, American Chemical Society: Washington D.C., p. 324–344. (80% of field sampling, 90% of laboratory analyses, 80% of manuscript preparation)

1994

20. Alpers, C.N., Blowes, D.W., Nordstrom, D.K., and Jambor, J.L., 1994, Secondary Minerals and Acid

Mine-Water Chemistry: In *Environmental Geochemistry of Sulfide Mine-Wastes*, Jambor, J.L., and Blowes, D.W. (eds.), Mineralogical Association of Canada, Short Course Notes, v. 22, Waterloo, Ontario, p. 247–270. (70% of manuscript preparation)

1995

21. Alpers, C.N., 1995, Responsibilities and activities of the U.S. Geological Survey related to mining and the environment. In *Workshop Report: Mine Waste Technical Forum*, Las Vegas, NV, July 25–27, 1995, U.S. Environmental Protection Agency, Washington, D.C., p. 3-53 to 3-63.

22. Hamlin, S.N., and Alpers, C.N., 1995, *Hydrogeology and Geochemistry of Acid Mine Drainage in Ground Water in the Vicinity of Penn Mine and Camanche Reservoir, Calaveras County, California: First-Year Summary*: U.S. Geological Survey Water-Resources Investigations Report 94-4040, 45 p. (50% of manuscript preparation)

23. Nordstrom, D.K., and Alpers, C.N., 1995, Remedial investigations, decisions, and geochemical consequences at Iron Mountain Mine, California: *Proceedings of Sudbury '95 - Mining and the Environment*. Hynes, T.P., and Blanchette, M.C. (eds.), May 28 – June 1, 1995, Sudbury, Ontario, Canada, CANMET, Ottawa. v. 2, p. 633–642. (50% of field work, 20% of manuscript preparation)

1996

24. Hamlin, S.N., and Alpers, C.N., 1996, *Hydrogeology and Geochemistry of Acid Mine Drainage in Ground Water in the Vicinity of Penn Mine and Camanche Reservoir, Calaveras County, California: Second-Year Summary, 1992-93*: U.S. Geological Survey Water-Resources Investigations Report 96-4257, 44 p. (50% of manuscript preparation)

1997

25. Rye, R.O., and Alpers, C.N., 1997, *The stable isotope geochemistry of jarosite*: U.S. Geological Survey Open-File Report 97-88, 28 p. (50% of field sampling, 20% of data interpretation, 15% of manuscript preparation)

1999

26. Alpers, C.N., and Nordstrom, D.K., 1999, Geochemical modeling of water-rock interactions in mining environments, in Plumlee, G.S., and Logsdon, M.J. (eds.), *The Environmental Geochemistry of Mineral Deposits. Part A. Processes, Methods, and Health Issues*, Society of Economic Geologists, Reviews in Economic Geology, v. 6A, chapter 14, p. 289–323. (70% of manuscript preparation)

27. Alpers, C.N., Hamlin, S.N., and Hunerlach, M.P., 1999, *Hydrogeology and Geochemistry of Acid Mine Drainage in Ground Water in the Vicinity of Penn Mine and Camanche Reservoir, California: Summary Report, 1993-95*. U.S. Geological Survey Water-Resources Investigations Report 96-4287, 59 p. (80% of study design, 70% of manuscript preparation)

28. Church, S.E., Alpers, C.N., Vaughn, R.B., Briggs, P.H., and Slotton, D.G., 1999, Use of lead isotopes as natural tracers of metal contamination — A case study of the Penn Mine and Camanche Reservoir, California, in Plumlee, G.S., and Filipek, L. (eds.), *The Environmental Geochemistry of Mineral Deposits. Part B. Case Studies*, Society of Economic Geologists, Reviews in Economic Geology, v. 6B, chapter 30, p. 567–583. (80% of study design, 30% of data interpretation, 20% of manuscript preparation)

29. Hunerlach, M.P., Rytuba, J.J., and Alpers, C.N., 1999a, Mercury contamination from hydraulic placer-gold mining in the Dutch Flat mining district, California, in Morganwalp, D.W., and

Buxton, H.T. (eds.), *U.S. Geological Survey Toxic Substances Hydrology Program -- Proceedings of the Technical Meeting, Charleston, South Carolina, March 8-12, 1999*, U.S. Geological Survey Water-Resources Investigations Report 99-4018B, p. 179–189. [80% of study design, 50% of data interpretation, 40% of manuscript preparation)

30. Jamieson, H.E, Alpers, C.N., Nordstrom, D.K., and Peterson, R.C., 1999, Substitution of zinc and other metals in iron-sulfate minerals at Iron Mountain, California: *in Proceedings, Sudbury '99 — Mining and the Environment II, Sudbury, Ontario, Canada*. (20% of field work, 20% of data analysis, 10% of manuscript preparation)

31. Nordstrom, D.K., and Alpers, C.N., 1999a, Geochemistry of Acid Mine Waters, in Plumlee, G.S., and Logsdon, M.J. (eds.), *The Environmental Geochemistry of Mineral Deposits. Part A. Processes, Methods, and Health Issues*, Society of Economic Geologists, Reviews in Economic Geology, v. 6A, chapter 6, p. 133–160. (30% of manuscript preparation)

32. Nordstrom, D.K., and Alpers, C.N., 1999b, Negative pH, efflorescent mineralogy, and consequences for environmental restoration at the Iron Mountain Superfund site, California, in Smith, J.V.,(ed.), *Geology, Mineralogy, and Human Welfare*, Proceedings of the National Academy of Sciences, USA, v. 96, p. 3455–3462. http://www.pnas.org/cgi/content/abstract/96/7/3455 (80% of study design, 80% of field work, 100% of preparation of pH standards and calibration of electrodes, 90% of analysis of solid samples, 40% of manuscript preparation)

33. Nordstrom, D.K., Alpers, C.N., Coston, J.A., Taylor, H.E., McCleskey, R.B., Ball, J.W., Ogle, S., Cotsifas, J.S., and Davis, J.A., 1999, Geochemistry, toxicity, and sorption properties of contaminated sediments and pore waters from two reservoirs receiving mine drainage, in Morganwalp, D.W., and Buxton, H.T. (eds.), *U.S. Geological Survey Toxic Substances Hydrology Program -- Proceedings of the Technical Meeting, Charleston, South Carolina, March 8-12, 1999*, U.S. Geological Survey Water-Resources Investigations Report 99-4018A, p. 289–296. (80% of study design, 100% of supervision of field work, 30% of manuscript preparation)

2000

34. Alpers, C.N., and Hunerlach, M.P., 2000, *Mercury contamination from historic gold mining in California*. U.S. Geological Survey Fact Sheet FS-061-00, 6 p. http://ca.water.usgs.gov/mercury/fs06100.html (80% of manuscript preparation)

35. Alpers, C.N., and Nordstrom, D.K., 2000, Estimation of pre-mining conditions for trace metal mobility in mineralized areas: An overview, in *Proceedings, International Conference on Acid Rock Drainage 2000, May 21–24, 2000, Denver, Colo.*, Society for Mining, Metallurgy, and Exploration, Inc., Littleton, Colo., p. 463–472. (75% of manuscript preparation)

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95. Flint, L.E., Guay, J.R., Flint, A.L., Curtis, J.A., and Alpers, C.N., 2005, Influence of climate on flow and sediment transport in the upper Yuba River basin, American River Science Conference, Sacramento, California, April 21-22, 2005. (TALK, presented by Flint)

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level fluctuations: Camp Far West Reservoir, California, Mercury 2006 – 8th International Conference on Mercury as a Global Pollutant, August 6-11, 2006, Madison, WI. (PRESENTED POSTER)

100. Curtis, J.A., Flint, L.E., Alpers, C.N., and Wright, S.A., 2006b, Evaluating sediment sources, erosion, and transport processes in the upper Yuba River watershed, Joint 8th Federal Interagency Sedimentation and 3rd Hydrologic Modeling Conferences, June 2-6, Reno, NV. (TALK)

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177. Williams, A.J., Sumner, D.Y., Alpers, C.N., Campbell, K.M., and Nordstrom, D.K., 2014, Biogenicity of hydrous ferric oxide mineralized microbial filaments and implications for detection with the Mars Curiosity Rover. Lunar and Planetary Science Conference, The Woodlands, TX, March 17-21, 2014. (TALK, presented by Williams) (IP-053593, USGS-approved Jan. 15, 2014)

2015

178. Alpers, C.N., 2015, Upstream prioritization through modeling: Sierra Nevada Mercury Impairment

Project. Reclaiming the Sierra 2015: The New Gold Rush, Sacramento, CA, April 20-21, 2015. (INVITED TALK, presented by Alpers) (no abstract)

179. Alpers, C.N., 2015, Arsenic and mercury contamination from historical gold mining in the Sierra Nevada, California. 27th International Applied Geochemistry Symposium (IAGS) hosted by the Association of Applied Geochemists (AAG) in Tucson, AZ, April 20-24, 2015. (INVITED KEYNOTE TALK, presented by Alpers) (IP-063703, USGS-approved Feb. 23, 2015)

180. Alpers, C.N., Yee, J.L., Ackerman, J.T., Orlando, J.L., Slotton, D.G., and Marvin-DiPasquale, M.C., 2015, Mercury concentrations in fish and sediment within streams are influenced by watershed and landscape variables including historical gold mining in the Sierra Nevada, California, American Geophysical Union Fall Meeting, to be held in San Francisco, CA, December 14-18, 2015. (TALK, to be presented by Alpers) (IP-067356, USGS-approved Aug. 17, 2015)

181. Campbell, K.M., Alpers, C.N., Runkel, R.L., and Nordstrom, D.K., 2015, Field and laboratory measurements for modeling microbial and abiotic Fe(II) oxidation at mine sites. Goldschmidt 2015, Prague, Czech Republic, August 20-24, 2015. (TALK, presented by Alpers) (IP-064785, USGS-approved April 2, 2015)

182. Curtis, J.A., Alpers, C.N., Howle, J.F., Monohan, C., Ward, A.J., Bailey, T., Burke, B, and Walck, C., 2015, An investigation of upland erosion and sources of fine-grained sediment in Humbug Creek and Malakoff Diggings State Historic Park, California using aerial and terrestrial LiDAR, mineralogy, geochemistry, and particle-size distribution. American Geophysical Union Fall Meeting, to be held in San Francisco, CA, December 14-18, 2015. (TALK, to be presented by Curtis) (IP-067683, USGS approved Sept. 11, 2015)

183. Domagalski, J.D., Majewski, M.S., Alpers, C.N., and Eckley, C., 2015, Comparison of mercury mass loading in streams to atmospheric deposition in selected watersheds in the western United States: Evidence for non-atmospheric mercury sources. Society of Environmental Toxicology and Chemistry, North America, 36th Annual Meeting, Salt Lake City, Utah, November 1-5, 2015. (TALK, not presented) (IP-066162, USGS-approved June 10, 2015)

184. Domagalski, J.D., Majewski, M.S., Alpers, C.N., and Eckley, C., 2015, Comparison of mercury mass loading in streams to wet and dry atmospheric deposition in watersheds of the western United States: Evidence for non-atmospheric mercury sources. American Geophysical Union Fall Meeting, to be held in San Francisco, CA, December 14-18, 2015. (POSTER, to be presented by Domagalski) (IP-067898, USGS-approved Aug. 31, 2015)

185. Sparks, G., Horner, T., Alpers, C.N., Cornwell, K., and Izzo, V., 2015, Mercury and methylmercury related to historical mercury mining in three tributaries to Lake Berryessa, Putah Creek Watershed, California. Reclaiming the Sierra 2015: The New Gold Rush, held in Sacramento, CA, April 20-21, 2015. (POSTER, presented by Sparks; won third place in student poster competition) (IP-062103, USGS-approved Jan. 8, 2015)

2016

186. Campbell-Hay, K.M., Alpers, C.N., and Nordstrom, D.K., 2016, Challenges and potential benefits of managing acidic mining influenced water. 251st American Chemical Society National Meeting and Exposition, San Diego, CA, March 13-17, 2016. (to be presented by Campbell) (IP-070102, USGS-approved Oct. 27, 2015)

INVITED TALKS, LECTURES, FIELD TRIPS, AND SHORT COURSES

1985-1999 – Summary and highlights

Invited talks at workshops, universities, and other research institutions:

During this period, I gave approximately 40 invited talks at various research institutions including universities and USGS offices. Some highlights: Stanford Univ. (1987), USGS-Menlo Park (1987), Univ. of Calif., Berkeley (1988, 1994, 1996), USGS-Denver (1988, 1989), USGS-Reston (1989), Univ. of Montana (1988), Univ. of Illinois (1989), McGill Univ. (1989), Univ. of Waterloo (1990), Univ. of Calif., Davis (1990, 1992, 1999), Univ. of Nevada, Reno (1992), Calif. State Univ. Sacramento (1994, 1998), Harvard Univ. (1996), Univ. of Calif., Santa Cruz (1996), and Univ. of Nebraska (1997).

Semester-long courses:

- Univ. of Michigan, Dept. of Geol. Sci. (1987) "Geochemical Thermodynamics"
- McGill Univ., Dept. of Geol. Sci. (1990) "Environmental Geology"
- McGill Univ., Dept. of Geol. Sci. (1991) "Hydrology and Geochemistry of Waste Disposal"

Short courses:

- Society of Economic Geology, short course on Environmental Geochemistry of Mineral Deposits (1993) "Geochemical Modeling in Mining Environments"
- Short course on Geochemical Modeling, American Society for Surface Mining Reclamation, Spokane, WA (1993) "Geochemical Modeling of Acid Mine Waters,"
- Short course on Metallogeny of Volcanic Arcs, British Columbia Geological Survey, Vancouver, BC, Canada (1998) "Geoenvironmental characteristics of massive sulfide deposits"

2000 - present

Invited talks at workshops, universities, research institutions, and stakeholder groups:

8/00 Western Region Colloquium, U.S. Geological Survey, Menlo Park, CA
"Environmental Legacy of the California Gold Rush: Mercury contamination and bioaccumulation"

2/01 Dept. of Geology colloquium, California State University, Sacramento, CA
"Environmental Legacy of the California Gold Rush: Mercury contamination and bioaccumulation"

3/01 Dept. of Geology seminar, California State University, Chico, CA
"Environmental Legacy of the California Gold Rush: Mercury contamination and bioaccumulation"

4/01 Dept. of Geology colloquium, Arizona State University, Tempe, AZ
"Evolution of negative pH waters and associated sulfate minerals at Iron Mountain, California"

9/02 CALFED Mercury Workshop-I, Monterrey, CA
"Conceptual model of mercury in Cache Creek"
"Mercury and methylmercury concentrations and loads within the Cache Creek watershed, California, January 2000 through May 2001"
"Synthesis of Cache Creek studies"

10/02 CALFED Mercury Workshop-II, Monterrey, CA
"Geoenvironmental setting: Natural and mining-related anthropogenic sources of mercury"

11/02 USGS-CSU Sacramento Science Symposium Series, Sacramento, CA
"Mercury contamination from historical gold and mercury mining in the Sierra Nevada and Trinity Mountains"

11/03 USGS, WRD brown-bag, Menlo Park, CA, "Mercury contamination from historical gold mining in the Sierra Nevada"

4/04 Dept. of Geology seminar, California State University, Chico, CA "Gold Rush Mercury Contamination in the Sierra Nevada: An Update on USGS Studies"

8/04 USGS 2004 Mercury Workshop, Reston, VA, "Non-atmospheric mercury contamination and bioaccumulation in mining-impacted watersheds"

2/05 Land, Air, and Water Resources Dept. colloquium, University of California, Davis, "Mercury contamination, methylation, and bioaccumulation in the Sierra Nevada: A Gold Rush Legacy."

11/05 CALFED Mercury Workshop, Sacramento, CA **"**Summary of Upper Yuba River Studies Mercury Research"

5/06 Dept. of Geology, California State University, Sacramento, lecture to undergraduate class in Ore Deposits: "Extreme acid mine drainage and associated sulfate minerals at Iron Mountain, California"

4/07 CALFED Mercury Workshop, Sacramento, CA, "DRERIP (Delta Regional Ecosystem Restoration Implementation Program) Mercury Conceptual Model"

4/08 Dept. of Geology, California State University, Sacramento, CA, lectures to undergraduate class in Ore Deposits: "Extreme acid mine drainage and associated sulfate minerals at Iron Mountain, California" and "Mercury contamination associated with historical gold and mercury mining in California"

5/08 Shlemon Conference on the Geological Assessment of Naturally Occurring Hazardous Substances, Association of Engineering Geologists (invited talk), Folsom ,CA: "Naturally Occurring Mercury in the California Coast Range and Sierra Nevada"

5/09-7/09 USGS WRD Lecture Series (6 USGS Water Science Centers: CO, ID, IN, MT, OH, and SD): "Mercury contamination, transport, methylation, and bioaccumulation in California watersheds affected by historical gold and mercury mining"

4/10 Larry A. Haskin Memorial Colloquium at Dept. of Earth and Planetary Sciences, Washington University in St. Louis, MO (invited talk): "Extremely acid mine drainage and associated iron-sulfate minerals at Iron Mountain, California"

3/11 California Environmental Education Foundation, 2010/11 workshop on Best Practices of Environmental Education and Stewardship (for K-12 teachers), Woodland, CA: "Mercury and arsenic contamination associated with historical mining in the Sierra Nevada, CA"

1/11 Univ. of Western Ontario, London, Ontario, Canada: "Mercury contamination, transport, methylation, and bioaccumulation in California watersheds affected by historical gold and mercury mining"

1/11 Univ. of Waterloo, Ontario, Canada: "Mercury contamination, transport, methylation, and bioaccumulation in California watersheds affected by historical gold and mercury mining"

1/12 Flyway Nights Lecture Series, Yolo Basin Foundation, Davis, CA: "A tale of two sources: Mercury contamination from historical mining in the Coast Ranges and Sierra Nevada, California"

10/12 Gateway Science Museum, Chico, CA: "A Gold Rush Legacy: Mercury contamination, methylation, and bioaccumulation associated with historical gold mining in the Sierra Nevada"

12/12 California Bioavailability Symposium, Richmond, CA: "Sierra Nevada Mercury Projects"

2/13 University of the Pacific, Stockton, CA: "Mercury contamination and bioaccumulation associated with historical gold mining in the Sierra Nevada"

9/13 U.S. Environmental Protection Agency, San Francisco, CA, Region 9 State-of-the-Science Workshop on Mercury Remediation in Aquatic Environments: "Mercury Contamination and Bioaccumulation from Historical Gold Mining in the Sierra Nevada – Site Characterization and Remediation"

5/14 Queen's Univ., Kingston, Ontario, Canada: "Iron Mountain, California"
10/14 Dept. of Geology seminar, California State University, Chico, CA: "Arsenic Bioavailability, Empire Mine State Historic Park"
11/15 Geology-Ecology-Environmental Science Colloquium, California State University, Sacramento, CA: "Arsenic Bioavailability at Historical Gold Mines in the Sierra Nevada"
11/15 Sierrans for Responsible Resources Development, Grass Valley, CA; "Research on Sediment and Mercury Transport in the South Yuba River, California"

Field trips:
9/01 Led field trip, CALFED Upper Yuba River Studies Program – for Technical Review Panel
5/02 Led field trip, National meeting of USGS Water Resources Division District Chiefs, "Legacy Mercury Contamination from Gold Rush Era Mining in the Sierra Nevada"
9/03 Led field trip, CALFED Upper Yuba River Studies Program – for Technical Review Panel
10/04 Led field trip to Yuba River for National Research Council / National Academy of Sciences, Review of USGS River Science, Sacramento, CA – field trip to Yuba River
10/07 Led field trip to hydraulic mining sites, Bear and Yuba Rivers, CA for USGS and Calif. State Univ., Sacramento Geology Dept.
11/09 Led field trip to Penn Mine, CA for Calif. State Univ., Sacramento Geology Dept. geochemistry class
4/10 Led field trips to Iron Mountain, CA for Calif. State Univ., Sacramento, CA and Calif. State Univ., Chico, CA Geology Depts.
10/11 Co-led field trip to Empire Mine State Historic Park, Grass Valley, CA, and Malakoff Diggins State Historic Park, Nevada City, CA for annual meeting of National Association of Abandoned Mine Lands Programs (NAAMLP), held in Squaw Valley, CA
11/11 Led field trip to Penn Mine, CA for Calif. State Univ., Sacramento Geology Dept. geochemistry class
5/12 Co-led field trip to Empire Mine State Historic Park, Grass Valley, CA for Reclaiming the Sierra conference, held in Nevada City, CA
6/12 Led field trip to Iron Mountain, CA for Univ. of California, Davis, Geology Dept.
6/14 Led field trip to Iron Mountain, CA for 2014 Goldschmidt Conference (30 participants)
6/14 Led field trip to Empire Mine State Historic Park, Grass Valley, CA for 2014 Goldschmidt Conference (50 participants)
4/15 Assisted with field trip to Malakoff Diggins State Historic Park and Combie Reservoir (Nevada and Placer Counties, CA) for Reclaiming the Sierra 2015 conference (25 participants)
10/15 Led field trip stop at South Fork American River, CA for California Science Teachers Association and California Water Education Foundation (30 participants)

Short courses:
11/00 Lectures on "Metal-sulfate salts from sulfide oxidation" and "Alunite-jarosite crystallography, thermodynamics, and geochronology," Short course on Sulfate Minerals – Crystallography, Geochemistry, and Environmental Significance, Mineralogical Society of America and the Geochemical Society, Tahoe City, CA
5/03 Lecture on "Extreme acid mine drainage from a pyritic massive sulfide deposit: The Iron Mountain end-member," Mineralogical Association of Canada, Short Course on Environmental Aspects of Sulfide Oxidation, Vancouver, BC, Canada
5/09 Co-instructor, Short Course on "Characterizing, Predicting, and Modeling Water from Mine Sites" (4 days including field trip), sponsored by California State Water Resources Control Board. I was responsible for teaching sections on mineral deposits, characterization methods, and geochemical modeling. Other instructors included D.K. Nordstrom (USGS), J. Hillenbrand (U.S. EPA) and three private-sector consultants.

6/14 Organizer and Instructor, 2-day Short Course on "Environmental Geochemistry, Mineralogy and Microbiology of Arsenic," Mineralogical Society of America and the Geochemical Society, Nevada City, CA. (50 participants, plus 13 instructors). I took the lead on arranging the logistics of the short course, I made a presentation on "Arsenic Associated with Historical Gold Mining in the Sierra Nevada Foothills," and I am co-editor of the resulting volume in *Reviews in Mineralogy and Geochemistry*.

Semester-long courses and guest lectures:

9/09 – 12/09 "Geochemistry" (Geology 123; 4 units) California State University Sacramento, Geology Department. (Co-instructor, with J. Domagalski; taught 50% of lectures, laboratories, and field trip)
8/11 – 12/11 "Geochemistry" (Geology 123; 3 units), California State University Sacramento, Geology Department. (Co-instructor; with J. Domagalski; taught 50% of lectures and field trip)
3/12 – 5/12 "Aqueous Geochemistry" (Geology 202; 3 units), California State University Sacramento, Geology Department (College of Continuing Education). (Co-instructor, with J. Domagalski; taught 50% of lectures)
8/12 – 12/12 "Environmental Geochemistry" (Geology 230; 3 units), California State University Sacramento, Geology Department (College of Continuing Education). (Co-instructor, with J. Domagalski; taught 50% of lectures and geochemical modeling exercises)
8/13 – 12/13 "Geochemistry" (Geology 123; 3 units), California State University Sacramento, Geology Department. (Co-instructor; with J. Domagalski; taught 50% of lectures and led field trip)
1/14 – 5/14 "Master's Thesis" (Geology 500; 6 units), California State University Sacramento, Geology Department. (Co-advising three graduate students on master's thesis research)
10/15 "Environmental Geochemistry" (Biology 186b; 3 units), California State University Sacramento, Biological Sciences Department (Guest lecture)

PROFESSIONAL MEMBERSHIPS

American Geophysical Union (AGU)
Geochemical Society
Geological Society of America (GSA)
- Environmental & Engineering Geology Division
- Geobiology & Geomicrobiology Division
- Geology & Health Division
- Hydrogeology Division
- Limnogeology Division
- Mineralogy, Geochemistry, Petrology & Volcanology Division
- Planetary Geology Division