Travis Lynn McLing

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SUMMARY

I have been working in the field of geology and geochemistry in one form or another since 1988. I have developed expertise in the fields of geologic mapping, fieldwork, carbon sequestration, geomicrobiology and hydrochemistry. I have spent a great deal of my time over the last 7 years working on the development of geochemical models to aid in the characterization of contaminant transport at contaminated sites. My current assignment is as the chief geologist for the Big Sky Carbon Sequestration Partnership and the Research Geosciences Group ant the INL. In this position, I have participated in projects ranging from geologic sequestration of carbon dioxide to developing enhanced in situ microbiological degradation of chlorinated solvents, and radioactive metals (strontium-90). These projects have received national recognition and have been instrumental in the development of strategies to clean up sites with contaminated groundwater.

EXPERIENCE RESEARCH SCIENTIST, 6/96-Present

Geosciences Research Department, Bechtel BWXT, Idaho LLC

Senior staff member in the INL's Geoscience Research Group. Research duties have a diversity of objectives but largely deal with geomicrobiological, hydrochemical and geologic aspects of the subsurface water rock/contaminant interactions. Additional responsibilities of the current position include conducting research, mentoring junior scientist and proposal writing. As part of the INEEL speakers bureau my duties include making presentations to many public and municipal organizations. Additionally, there have been many opportunities to teach primary and secondary students the principles of geology, with special emphasis on how these principles relate to the surroundings.

Co-authored and lead PI for the geologic branch of the Big Sku RegionalCarbon Sequestration Partnership, a national carbon sequestration partnership funded by the US DOE. The Big Sky Carbon Sequestration Partnership (BSCSP), led by Montana State University, Bozeman, MT, will identify and catalogue CO_2 sources and promising geologic and terrestrial storage sites, develop a risk assessment and decision support framework to optimize the area's carbon storage portfolio, enhance market-based carbon storage methods, identify advanced greenhouse gas measurement technologies to improve verification, support voluntary trading and stimulate economic development, call upon community leaders to define carbon-sequestration strategies, and sponsor forums that involve the public. Idaho, Montana, Washington, Oregon and South Dakota are served by this partnership that is comprised of 13 organizations, including the Confederated Salish and Kootenai Tribes and the Nez Perce Tribe.

The region has both industrial and agricultural greenhouse gas (CO_2, methane, and nitrous oxide) emissions from three major sources: fossil fuel power plants, industrial plants, including metals processing, chemical plants, and ethanol production facilities, and agricultural operations, principally feedlots.

Over the last 10 years I have been part of a research team that has studied and developed a Site Wide hydrologic fate and transport model for the INL's OU 10-08 group. I have been the lead geologic/geochemist for this group with responsibilities that continue to the present time.

Co-author and Investigator for an EMSP proposal that has been funded for fiscal years 2003-2006 to conduct research at the INEEL's Vadose Zone Research Park. This study is aimed at obtaining a better understanding of vadose zone flow and transport processes at the field scale and establishing defensible links between laboratory and field-derived transport parameters for conservative and reactive elements in the sediment and basalt hosted vadose zone at the INEEL.

Exhibit____(TLM-1)

Geoscience lead for research being conducted in the ESRP aquifer to investigate the ability of indigenous microbial populations to co-precipitate metal contaminants from groundwater effectively removing them from the water column. This study has two main goals 1) determine the effectiveness of using urea as a means of increasing aquifer pH and calcite precipitation, and the subsequent co-precipitation of divalent metals and radio nuclides (i.e. 90-Sr), and 2) use 13-Carbon labeled methane as a way of assessing the indigenous rates of methanotrophic (microbial methane utilization) activity and the co-metabolism of trichloroethylene (TCE). Once calcite precipitation takes place it is stable for long periods and therefore any contaminants co-precipitated within the mineral will be effectively removed from the contaminant plume.

Co-authored a proposal that has been funded to conduct a study of the physical and chemical characteristics of the Eastern Snake River Plain Aquifer. This project will significantly increase the ability of INEEL scientist and modelers to predict the impact that past and future site operations will have on the aquifer and surrounding communities.

Research funded by the Department of Energy to study the paleoclimatic and microbiological conditions of a mid-latitude glacier in Wyoming. This project involves INL, the National Oceanic and Atmospheric Administration, the US Department of Energy, the US Geological Survey and several state Universities. I have also performed computer-modeling studies of the Snake River Plain aquifer to determine the relative contribution of various aquifer host rocks to the overall chemical budget of the aquifer. The goal of this work is to better understand the fate and transport of contaminants generated by waste disposal activities.

ASSOCIATED WESTERN UNIVERSITIES POST GRADUATE, 5/94-6/96

Subsurface and Environmental Modeling Unit, EG&G Idaho. Lockheed/Martin Idaho Technologies Company

Worked to develop a hydrochemical model for Sr^{90} uptake in contaminated aquifers by irreversible co-precipitation in calcite. Worked as the geochemist and field team leader conducting laboratory and field investigations of the relationship of geochemical heterogeneity to physical and geologic variation in aquifer properties. This basic research sponsored by DOE's office of health and environmental research is focused on elucidating the role of geochemical heterogeneity on reactive transport. Specific responsibilities included organizing more than 20 investigators from four national laboratories and five universities into a cohesive team to conduct fieldwork in a remote area of Virginia. In addition, I performed preliminary geochemical modeling in order to scale field and laboratory experiments properly, and collaborated with senior investigators in the preparation of scientific manuscripts.

ASSOCIATED WESTERN UNIVERSITIES, THESIS FELLOWSHIP, 10/92-5/94

Idaho State University, Department of Geology, Idaho National Engineering Laboratory

Designed and conducted a comprehensive investigation of the geochemistry of the Snake River Plain beneath the INEEL. This worked required extensive study of the processes involving water rock interactions, manipulation of geochemical computer codes and interaction with established scientist who had studied such systems. Through this work I generated the most complex and complete study of the Snake River Plain Aquifer to date.

SUMMER INTERN IDAHO NATIONAL ENGINEERING LABORATORY, 6/92-10/92

Subsurface and Environmental Modeling Unit, EG&G Idaho.

Performed geochemical modeling to assess the long-term pore fluid chemistry in concrete low-level radioactive waste disposal vaults. The study involved the extensive use of geochemical computer models to assess the interaction between groundwater moving though waste disposal vaults and the high pH pore fluid generated within concrete storage vessels, in order to asses the rate at steel waste container corrode.

EDUCATION Currently in a PhD program at the University of Idaho, Idaho Falls ID.

MASTER OF SCIENCE - GEOLOGY, 5/94

Idaho State University, Pocatello Idaho

GPA 3.80

BACHELOR OF SCIENCE - Geology, 12/91

Idaho State University, Pocatello, Idaho

GPA 3.53 State of Idaho geology student of the year 1991

ASSOCIATES DEGREE - GEOLOGY, 4/90

Ricks College, Rexburg, Idaho

INDUSTRY

PUBLICATIONS

McLing, T.L., Roback, R.C. Use of aquifer temperature distribution and chemical/isotopic characteristics to define groundwater flow paths at the Idaho National Laboratory, In press. Proceeding of the Great Rift Science Symposium.

McLing T.L. Smith R. P., Blackwell D.D.,. Roback, R. C., and Rohe M. J.,Temperature distribution, aquifer geometry, and groundwater flow in the Snake River Plain aquifer, Eastern Snake River Plain, Idaho, In Press Geological Society of America Bulletins

Helm-Clark C., McLing, T.L., Ansley, S., Wood, T.R. (2005) Borehole and Well Middle 1823 and its Relationship to the Stratigraphy of the South Central Idaho National Laboratory. US Department of Energy Report number ICP/EXT-05-00790

Baker, K.E., T.M. McLing, L.S. Street, A.L. Schafer, S. Ansley, L.C. Hull, R.M. Holt, R.C. Roback, and C. Jones. 2005. A Research Park for Studying Processes in Unsaturated Fractured Media. Eos Transactions, AGU 86:15, 19.

Colwell, F. S., Smith, R. W., Ferris, F. G., Reysenbach, A., Fujita, Y., Tyler, T. L., Taylor, J. L., Banta, A., Delwiche, M. E., McLing, T. L., Watwood, M. E. Microbially Mediated Subsurface Calcite Precipitation for Removal of Hazardous Divalent Cations: Microbial Activity, Molecular Biology, and Modeling. In *Subsurface Contamination Remediation: Accomplishments of the Environmental Management Science Program*; Berkey, E., Zachry, T., Eds.; American Chemical Society Symposium Series 904; American Chemical Society: Washington, DC, 2005; pp 117-137.

McLing, T. L., Smith, R. W., and Johnson, T.M., (2002) Chemical Characteristics of Thermal Water Beneath the Eastern Snake River Plain Aquifer, GSA Special Paper 353-13.

Johnson T. M., Roback R. C., McLing T. L., Bullen T. D., DePaolo D. J., Doughty C., Hunt R. J., Murrell M. T., and Smith R. W. (2000). Groundwater Fast Paths' in the Snake River Plain Aquifer: Radiogenic Isotope Ratios as

Natural Groundwater Tracers, Geology, 28, 871-874.

Luo, S. T. L. Ku, R. Roback, M. Murrell, and T. L. McLing., (2000). Decay-series Disequilibrium Study of In-situ, Long-term Radionuclide Transport in Water-rock Systems. Proceedings on Scientific Basis for Nuclear Waste Management XXIII, Material Research Society

Lou S. Ku T.L., Roback R, Murrell M., and McLing T. L., (2000). In-situ Radionuclide Transport and Preferential Groundwater Flows at INEEL (Idaho): Decay-Series Disequilibrium Studies. Geochemica et. Cosmochimica Acta, Vol 64, No. 5, pp. 867-881.

Luo, S., Ku, T.-L., Roback, R ., Murrell, M., McLing, T., 1998, Uranium-series disequilibrium in groundwater: Assessing radio-nuclide migration: International Conference on Isotope Geology, Cosmochemistry and Geochronology, Beijing.

Johnson, T.M., Dipak, S. Doughty, C. Depaolo, McLing, T.L., Smith, R.W., (1998). Investigations of Groundwater Flow Paths in Fractured Aquifers Through Combined Inversion of Strontium Isotope Ratios and Hydraulic Head Data Environmental Management Science Program Workshop.

Rosentreter, J.J.; Quarder, H.S.; Smith, R.W.; McLing, T. (1998). Uranium Sorption onto Natural Sands as a Function of Sediment Characteristics and Solution pH. Metal Absorption by Earth Materials. Academic Press: San Diego, CA

Groenewold, G. S., Ingram, J. C., McLing, T. L., Gianotto, A. K., (1997). Cs^+ Speciation on Soil Particles by TOF-SIMMS Imaging. Analytical Chemistry Vol. 70, No 3, pg. 534-539

Roback R. C., Johnson T. M., McLing T. L., Murrell M. T., Luo, S. and Ku, T.-L. (2001) Uranium isotopic evidence for groundwater chemical evolution and flow patterns in the eastern Snake River Plain aquifer, Idaho, Geol. Soc. Amer. Bull., 113, 1133-1141.

Roback R. C., Johnson T. M., McLing T. L., Murrell M. T., Luo, S. and Ku, T.-L. (2001) Uranium isotopic evidence for groundwater chemical evolution and flow patterns in the eastern Snake River Plain aquifer, Idaho, Geol. Soc. Amer. Bull., 113, 1133-1141.

Rosentreter, J. J., Hemming, C., Smith, R. W., McLing, T. L., (1997). Uranium Sorption onto Natural Sands as a Function of Solution Sediment Characteristics. In Adsorption of Metals by Geomedia Variables, Mechanisms, and Model Applications. Editor Everett A. Jenne. Academic Press.

Quander, S. T., Rosentreter, J., Smith, R. W., and McLing T. L., 1996, The Adsorption of Uranium on Iron Coated Sands, Proceedings of the Annual Meeting of the American Chemical Society.

Swift, Donald J. P., B. S. Parsons, A. Muller, J. L. Wilson R.G. Taylor, R. Holt, R. Smith, A. Schafer, and T. McLing, (1996). Sedimentary Facies as a Guide to Hydrologic Properties in an Experimental Aquifer of Shallow Marine Origin: Virginia's Eastern Shore Peninsula. Transactions American Geophysical Union, 1996 Spring meeting v. 76.

Smith, R. W., McLing, T. L., (1996). Relationship Between Reactivity and Permeability for Porous Media Composed of Coated Grains. Geol. Soc. of Amer. Programs 25:A-320

McLing, T. L., Smith R. W., Pre-Anthropogenic Groundwater Evolution at the Idaho National Engineering Laboratory, Idaho, in Link, P.K. editor, (1994). Hydrology, Waste Disposal, Science and Politics, Proceedings of the 30th

symposium on Engineering Geology and Geotechnical Engineering, College of Engineering, Idaho State University, Pocatello, Idaho.

McLing, T.L., 1994, The Pre-Anthropogenic Groundwater Evolution at the Idaho National Engineering Laboratory, Idaho, Master of Science Thesis, Idaho State University, Pocatello, Idaho.

SELECTED PRESENTATIONS

Colwell, F.S., Smith, R.W., Ferris, F.G., Ingram, J.C., Reysenbach, A.-L,[4] Fujita, Y. Tyler, T.L., Taylor, J.L., Banta, A., Delwiche, M.E., McLing, T.L. M.M. Cortez,. Watwood M.E., (2003) Microbially-Mediated Subsurface Calcite Precipitation for Removal of Divalent Metals and Radionuclides in Arid Environments Int. Symp on Subsurface Microbiology.

McLing, T.L, Smith, R.P., Roback, R.C., Elizabeth, J.G, Blackwell, D. D, Johnson, T.M., (2002). Using Environmental Isotopes, Geochemistry, and Aquifer Temperature to Address Flow Regimes within the Eastern Snake River Plain Aquifer at the Idaho National Engineering and Environmental Laboratory.

E. G. Johnson, T. McLing, and R. M. Holt. (2002). Diffusion as a Rate Limiting Factor on the Evolution of Strontium Isotope Ratios in Fractured Rock. American Geophysical Union Annual meeting.

Colwell, F.S., Smith, R.W., McLing, T.L. Microbially-Mediated Subsurface Calcite Precipitation for Removal of Divalent Metals and Radionuclides in Arid Environments Int. Symp on Subsurface Microbiology, 2002.

Smith, R.W., McLing, T.L., Schafer, A.L. (2001) Physical and Chemical Heterogeneity of a Sand Outcrop Near the Oyster, Virginia NABIR Bacterial Transport Site. American Geophysical Union Annual meeting.

E. G. Johnson, T. McLing, and R. M. Holt. (2001). Conceptual Hydrogeologic Models for the Eastern Snake River Plain, Idaho. American Geophysical Union Annual meeting.

Smith, R.W., Colwell, F.S., Lehman, R.M., McLing T.L., McKinley J.P. (1999). Vertical Variations in Composition for TCE Contaminated Groundwater at the Test Area North (TAN), Idaho National Engineering and Engineering Laboratory, Idaho.

McLing, T.L. Smith, R.W., (1999). The Pre-Anthropogenic Groundwater Chemical Evolution of the Snake River Plain Aquifer System, at the 30th symposium on Engineering Geology and Geotechnical Engineering, Boise, Idaho

Fryar, A. E., Nodurft, E. N., Royer, J. M., Smith, R. W., Colwell , F.S., McLing, T, L., Experimental Measurement of Trichloroethene uptake by Snake River Plain Basalt. Geol. Soc. of Amer. Programs 29: A-383 (1997).

McLing, T. L., Smith R. W., Johnson T. J., The Effect of Hydrothermal Water on the Snake River Plain Aquifer. Geol. Soc. of Amer. Programs 29: A-323 (1997).

Smith R. W., McLing, T. L., Schafer A. L., Wilson, J. L., Swift, D. J., Relationships between Geochemical and Physical Heterogeneities, American Geophysical Union (1997)

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Smith, R.W., Lee, A., McLing, T.L., Schafer, A.L. (1994) Relationship between Secondary Iron Oxyhydroxides and Sedimentological Properties for A Pleistocene Barrier Shoal Complex: Implications for Waste Transport, Geological Society of America annual meeting.