

**STATE OF NEW MEXICO  
BEFORE THE WATER QUALITY CONTROL COMMISSION**

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**In the Matter of:** )  
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**PROPOSED AMENDMENT** )  
**TO 20.6.2 NMAC (Copper Rule)** )  
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**No. WQCC 12-01(R)**

**EXHIBIT FINLEY - 1**

## EDUCATION

Ph.D., Geology/Geochemistry/Hydrology, University of Wyoming, 1992

M.S., Geology/Hydrology, Colorado State University, 1984

B.S., Forestry, University of Montana, 1979

## PROFESSIONAL EXPERIENCE

Telesto Solutions, Inc., Fort Collins, Colorado, *Principal, Senior Geochemist*, (Feb. 2001-Present)

GeoTrans, Inc., Fort Collins, Colorado, *Hydrologist/Geochemist*, (June 2000 – Feb. 2001)

Shepherd Miller, Inc., Fort Collins, Colorado, *Senior Geochemist*, (1996–May 2000)

Department of Geology, Miami University, Oxford, Ohio, *Assistant Professor*, (1993–1996)

Department of Geology & Geophysics, University of Wyoming, Laramie, Wyoming, *Post-doctoral Research Associate*, (1993)

Department of Geology & Geophysics, University of Wyoming, Laramie, Wyoming, *Graduate Research Assistant*, (1989–1993)

Dr. Finley has over 20 years of experience in the application of geochemical and hydrological principles to address water quality and management issues in a variety of environments associated with natural resource extraction and use. His work experience includes teaching geology and geochemistry at the University level, providing consulting services to the mining industry, and providing technical support in geochemistry and hydrology with both State and County regulatory agencies. Dr. Finley has expertise in the following technical areas: aqueous geochemistry, geochemical modeling, isotope geochemistry and hydrology, trace metal chemistry, watershed hydrology, and dynamic systems modeling. He has also provided technical services as an expert witness in regard to the influences of hydrology and geochemistry as related to hard rock mining on surface and ground water chemistry.

## RELEVANT PROJECT EXPERIENCE

**Dynamic Systems Modeling**—Dr. Finley has worked extensively to extend the method of dynamic systems modeling to mining-related environments. Dynamic systems modeling is a computer-simulation environment that focuses on time-dependent systems and provides the basis for investigating, describing, and optimizing water and chemical management systems. Dynamic systems modeling has proven useful in simulating large, complicated water management systems coupling the effects of natural hydrologic processes, mining and milling process flows, and artificially and natural imposed chemical modifications. Example applications include: (1) simulating the water management system at an operating copper mine that supported the water demands associated with a milling facility, heap leach facility, and the domestic water supply for a small town, (2) projecting the chemical evolution of several pit lakes to understand the probable range of constituents concentrations over time, and (3) representing water management systems to provide the basis for evaluating and optimizing closure options for mining-related facilities. Dr. Finley has also used dynamic systems modeling as a communication tool to educate

stakeholders of diverse experience and expertise on specific mining-related water management issues.

**Geochemistry**—Dr. Finley combines extensive educational training and abundant field-based practical experience in geochemistry and hydrology to effectively address water-related issues. He has conducted field-based investigations with regard to the geochemistry of water and solid materials associated with metal mines. Dr. Finley has completed geochemical investigations that included: (1) developing a sampling method to ensure adequate characterization of the geochemical system, (2) specifying laboratory analytical methods and reviewing analytical data for quality control and quality assurance, (3) designing and implementing laboratory experiments that support the geochemical investigation, and (4) interpreting and describing results. He also has extensive experience in the application of geochemical modeling (e.g., MINTEQ and PHREEQC) to mining-related water quality investigations with special emphasis on trace metal interactions (e.g., precipitation, co-precipitation, and surface adsorption). Dr. Finley also has experience in radionuclide geochemistry (uranium, radium, etc.) in terms of geochemical reactivity, mobility, and transport. Dr. Finley's academic research was primarily focused on silicate mineral weathering and that knowledge has proven useful in fully integrating the potential extent of geochemical neutralization reactions that may occur in hydrologic system that have been affected by acid rock drainage. His knowledge of stable and radiogenic isotope geochemistry has also proven useful in the characterization of hydrogeochemical systems (including consideration of natural background) associated with mining-related environments.

**Project Management**—Dr. Finley has managed a variety of projects ranging from basic research related to the geochemistry and hydrology of natural systems to consulting services to the mining industry. Although formally trained as a geochemist and hydrologist, Dr. Finley has extensive knowledge of other technical disciplines that are required to ensure successful project organization, design and implementation.

For example, Dr. Finley served as the manager for a project that required a multi-disciplinary investigation to characterize and control the flow of ground water from a reclaimed and backfilled open pit. The project required managing and integrating input from several consulting companies, directing a variety of staff from physical scientists to engineers, and oversight of interim and final report preparation. In addition, the project also required extensive communication with regulatory agencies and private citizen groups to obtain the permits necessary to implement the ground water remediation design. Dr. Finley's written and oral communication skills were instrumental in successfully convincing regulatory and private stakeholders as to the efficacy of the interpretation of the hydrologic and geochemical system and the viability of the remedial design.

## **PROFESSIONAL AFFILIATIONS AND REGISTRATIONS**

American Geophysical Union

International Association of Geochemistry

Geological Society of America

Professional Geologist, Wyoming (PG-3079)

Member Geological Society of America Committee, Geology & Public Policy (term expired)

Member Fort Collins, Colorado Water Board (term expired)

## **PUBLICATIONS**

- Finley, J.B. 2000. "Contaminant Transport Hazards During Flooding." In, E.E. Wohl, ed., *Flood Hazards in the Riparian Environment*. Cambridge University Press.
- Finley, J.B., R.C. Ford, K. Behnke, J. Danni. 2000. "Management of Acid Drainage at Mining Facilities Using Dynamic Systems Modeling (DSM)." Proceedings of the 4<sup>th</sup> International Conference on Acid Rock Drainage, Denver, CO, May 22 to May 24.
- Finley, J.B. and J.I. Drever. 1997. "Chemical Mass Balance and Rates of Mineral Weathering in High-Elevation Catchments." *Hydrological Processes*, vol. 11, pp. 745-764.
- Finley, J.B., J.I. Drever, and J.T. Turk. 1995. "Sulfur Isotope Dynamics in a High-Elevation Catchment, West Glacier Lake, Wyoming." *Water, Air and Soil Pollution*, vol. 79, pp. 224-241.
- Drever, J.I. and J.B. Finley. 1993. "Weathering and Pedogenesis at the Watershed Scale: High-Elevation Catchments in Silicate Terrains." *Chemical Geology*, vol. 107, pp. 289-292.
- Mazor, E., J.I. Drever, J.B. Finley, P.W. Huntoon, and D.A. Lundy. 1993. "Hydrochemical Implications of Groundwater Mixing: An Example from the Southern Laramie Basin, Wyoming." *Water Resources Research*, vol. 29, pp. 193-205.

## **ORAL PRESENTATIONS AND SHORT COURSES**

- Rathburn, S.L., J.B. Finley, S.M. Klein, and Whitman, B.R. 2004. "Assessing Reservoir Sedimentation Using Bathymetric Comparison and Sediment Loading Measurements." Geol. Soc. Am., Abstracts with Programs, Vol. 36, No. 5. October.
- Rathburn, S.L., J.B. Finley, S.M. Klein, and S.R. Smith. 2002. "A Sediment Budget for a Semi-Arid Reservoir: Preliminary Results." American Geophysical Union Fall Meeting, San Francisco, CA. December 5-11.
- Finley, J.B., W.L. Niccoli, and R.C. Ford. 2002. "Application of Dynamic Systems Modeling to Integrate Hydrologic Processes in Mine Settings." 2002 Society of Mining and Metallurgical Engineers Annual Meeting, Phoenix, AZ, March 25 – 27.
- Finley, J.B., L.E. Eary, M. Shields, D.D. Runnells. 2000. "Dynamic Systems Modeling: A Method for Extending the Modeling of Pit-Lake Hydrology and Geochemistry." Workshop on the Characterization, Modeling, Remediation, and Monitoring of Pit Lakes, Sponsored by the U.S. Environmental Protection Agency, Reno, NV, April 4 – 6.
- Finley, J.B. and W. Niccoli. 1999. Short course entitled, "Mine Closure Design – Mine Pit Lakes/Groundwater & Surface Water Baseline Data." Presented at the Mine Design, Operations & Closure Conference, April. Polson, MT.

**Jim B. Finley, Ph.D., P.G.**  
***Principal/Senior Geochemist***

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- Finley, J.B., M. Shields, and D.D. Runnells. 1999. "Managing Water Quantity and Quality Using Dynamic Systems Modeling." Presented at the Mine Design, Operations & Closure Conference, April. Polson, MT.
- Finley, J.B. and D.D. Runnells. 1998. "Managing Arsenic and Selenium in Mining Operations." Presented at the 1<sup>st</sup> Annual Workshop on Heavy Metal Contaminants in Water, U.S. EPA, U.S. DOE, U.S. Army Corps of Engineers, and MSE Inc., Butte, MT.
- Finley, J.B., M. Shields, and D.D. Runnells. 1998. "Application of Dynamic System Modeling: A Simulation Tool for Water Management for the Mining Industry." Presented at the Annual Environmental Managers Meeting, Kinross Gold, USA, Fairbanks, Alaska.
- Finley, J.B., D.D. Runnells, and R.C. Laird. 1998. "Seasonal Recharge and Manganese Concentrations in an Alluvial Aquifer, Platoro, Colorado." American Water Resources Association—Colorado Section, Annual Meeting, Denver, Colorado.
- Shields, M., J.B. Finley, and D.D. Runnells. 1998. "Water and Chemical Mass Balance Modeling at Mine Sites: A Dynamic System Approach." American Water Resources Association—Colorado Section, Annual Meeting, Denver, Colorado.
- Finley, J.B., D.D. Runnells, and J.F. Callender. 1997. "Isotope Geochemistry of a Low pH, Metal-Bearing Ground Water Plume, Southwest Jordan Valley, Utah." Geol. Soc. Am. Abstracts with Programs, Vol. 29.
- Hall, D.J., J.W. Birkinshaw, C.R. Stevens, J.F. Callender, J.R. Bowman, D.K. Solomon, and J.B. Finley. 1997. "Investigation of Flow and Transport Model Parameters at the Bingham Canyon Mine, Southwest Jordan Valley, Utah." Geol. Soc. Am. Abstracts with Programs, Vol. 29.
- Jett, S.M. and J.B. Finley. 1996. "Inorganic Phosphate Cycling in a Eutrophic, Warm-Water Lake." EOS, Trans. Am. Geoph. Union, vol. 77.
- Finley, J.B. and D.K. Nordstrom. 1994. "Evaluation of the Chemical Model in WATEQ4F: 1. The Major Ion Activity Coefficients—Na, K, Ca, Mg, Cl." Mineral. Mag. vol. 58A, p. 270-271.
- Finley, J.B., J.M. Beiswenger, and J.I. Drever. 1994. "Palynologic, Sedimentologic, and Geochemical Evidence of Environmental Conditions During Recent Deglaciation, West Glacier Lake, Snowy Range, Wyoming." Geol. Soc. Am. Abstracts with Programs Vol. 26, pp. A62.
- Finley, J.B., J.I. Drever, and C.D. Frost. 1993. Eolian Flux to an Alpine Catchment, Snowy Range, Wyoming. Geol. Soc. Am. Abstracts with Programs, Vol. 25, pp. A318.
- Finley, J.B., J.I. Drever, and J.T. Turk. 1993. "Sulfur Isotope Dynamics In a High-Elevation Catchment, West Glacier Lake, Wyoming." 2nd Int. BioGEOMon, Abstract, Prague, Czech Republic, September 1993.
- Finley, J.B. and J.I. Drever. 1992. "Seasonal Variations of Geochemical Processes in an Alpine Catchment, Snowy Range, Wyoming." EOS, Trans. Am. Geoph. Union vol. 73, pp. 178.

Finley, J.B. and J.I. Drever. 1991. "Solute Budgets in an Alpine Catchment: A Process-Level Investigation." EOS, Trans. Am. Geoph. Union, vol. 72, pp. 204.

Finley, J.B. and J.I. Drever. 1991. "Sulfur Sources in the Glacier Lakes Catchment, Snowy Range, Wyoming." 2nd Int. Symp. Environ. Geochem., Abstract, Uppsala, Sweden, September 1991.

## **PROJECT EXPERIENCE – GEOCHEMICAL CHARACTERIZATION**

San Luis Mine, Colorado: conducted geochemical evaluation of pit backfill materials, surrounding pit wall materials, and adjacent alluvial valley fill to determine redox response and general geochemical weathering characteristics of materials. Resulting data, along with ground water chemistry data, were used to predict rinsing times of pit backfill and regulatory permitting.

Platoro Mine, Colorado: mine-related materials were evaluated for geochemical properties as part of a larger evaluation to determine chemical mass loading sources emanating from the mine area. Solids analyses were combined with surface and ground water chemistry to develop a conceptual model of chemical mass production from background and mining-related sources.

Tohono Mine, Arizona: extensive geochemical characterization of heap, pit, and evaporation pond materials. Developed a sampling and analysis plan for a PA/SI conducted by Region 9 EPA. Developed conceptual models of geochemical weathering of heap materials and the impact on acid consumption and heap hydraulics. Developed a pit lake hydrogeochemical model (using dynamic systems modeling) to predict long-term pit water quality.

Golden Sunlight Mine, Montana: conducted geochemical characterization of waste rock to determine changes in mineralogy, and grain size, associated with sulfide oxidation. Conducted geochemical characterization of tailings materials for combination with a geotechnical and hydrologic evaluation to predict long-term tailing draindown chemistry.

Idaho Cobalt, Idaho Project: lead geochemist and project manager providing baseline hydrologic and geochemical characterization in support of a NEPA evaluation, lead developer of a dynamic systems model to evaluate potential impacts to the environment, lead technical representative for proponent, interactions with Idaho Department of Environmental Quality and Region 10 EPA

El Galeno Project, Peru: project manager for implementing a geochemical characterization program testing mine rock materials based on the current mine plan. Testing included standard static test procedures (ABA, MWMP, NAG) and humidity cell testing, which was conducted in Telesto's laboratory. Results of geochemical testing were used in developing conceptual geochemical models of project facilities and in making water chemistry predictions for use in completing the ESIA and BFS for the current mine plan.

Magistral Project, Peru: served as lead geochemist in analysis of geochemical test data developed by a third-party consultant. Available geochemical data were used to predict drainage water chemistry associated with rock repositories and supported development of the project ESIA and BFS.