

**Education**

*Master of Science Geology,  
University of Manitoba,  
2004*

*Bachelor of Science  
Geology (Honors),  
University of Manitoba,  
2001*

**Languages**

*English – Fluent*

**Golder Associates Ltd. – Vancouver****Employment History****Golder Associates – Vancouver, BC**

*Geochemist (2004 to Present)*

Associate and Senior Geochemist with background in environmental and exploration geology. Project experience includes the development and execution of geotechnical baseline studies, including estimates of acid rock generation and metal leaching potential, for a number of projects in North American and abroad. Hydrogeochemical modelling experience generally involves the incorporation of the results of baseline geochemical characterization to predict long term water quality for the purpose of permitting and development of mitigation alternatives. Field investigation activities include sampling at active and abandoned mine sites for the purpose of waste characterization, field oversight of drilling and logging of geologic materials, ground water and surface water sampling, and data analysis.

**New Britannia Mine, Kinross Gold Corp. – Snow Lake, Manitoba**

*Core Logging Geologist (September 2001 – April 2002 to August 2003 -  
September 2003)*

Geologic description of diamond drill core for New Britannia Mine for the purpose of gold exploration and mine reserve estimation.

**University of Manitoba – Winnipeg, Manitoba**

*Master of Science Candidate (2002 to 2004)*

Responsibilities included acting as a teaching assistant for courses including Introductory Physical Geology, Optical Mineralogy and Mineral Deposits in the Department of Geology at the University of Manitoba.

**EBA Engineering Consultants, Ltd. – Yellowknife, N.W.T**

*Environmental Scientist (1) (May 2002 to August 2002)*

Tasks included geotechnical quality control investigations, including supervision and logging of diamond drill core at Diavik Diamond Mine site and aggregate quality control in Fort Smith, NWT.

**DeBeers Canada Exploration Incorporated – Manitoba**

*Junior Sampler (May 2001 to July 2001)*

Planned and completed 2 to 4 km traverses for the purpose of bulk till sampling, kimberlite prospecting and reconnaissance mapping.

**Manitoba Industry, Trade and Mines, Geological Survey –  
Wabowden, Manitoba**

*Junior Geological Assistant (May 2000 to August 2000)*

Responsibilities included logging and graphical representation of core retrieved from Bucko core storage site for compilation map of the Thompson Nickel Belt, collaboration and reconnaissance mapping at Sipiwesk Lake, Manitoba.



### ***University of Manitoba – Winnipeg, Manitoba***

*(May 2000 to October 2000)*

Responsibilities included sampling of Central Manitoba Mine Tailings, Nopiming Provincial Park (Manitoba, Canada) for mineralogical and geochemical study of orphaned mine tailings.



## **PROJECT EXPERIENCE – MINING**

**Sabina Gold & Silver  
Corp. / Back River  
Project  
Nunavut, Canada**

Geochemistry and water quality predictions for the Back River Project. Scope of work includes detailed review of existing geochemical assessment completed for the Project for purpose of confirmation of acid rock drainage and metal leaching potential, including support for mine waste management protocols during construction and operation. In addition, water quality predictions for Type A water license were updated based on feedback from intervenors.

**Fundacao Renova /  
Samarco Project  
Brazil**

Geochemical evaluation of iron ore tailings released as from the Fundao Tailings Dam failure. Scope of work included development of a detailed geochemical characterization report to determine the mechanisms of metal mobility from tailings in the receiving environment. A colloid investigation study design was prepared and implemented to evaluate the composition, source and mechanisms of mobilization of suspended particulates in the receiving environment.

**Walter Energy / EB  
Project  
British Columbia,  
Canada**

Detailed assessment of the geochemical characteristics of mine rock from a proposed coal mine in northern British Columbia. Developed a geochemical testing program to evaluate metal leaching potential in site specific conditions, including specialized long-term leach tests and detailed mineralogical analysis. Data was incorporated into an existing geochemical dataset for the Project.

A geochemical characterization plan was developed to provide recommendations for geochemical classification and monitoring of mine rock during operations.

**Red Chris  
Development  
Corporation / Red  
Chris Mine, British  
Columbia, Canada**

Assistance in the preparation of a Mine's Act Permit Amendment for the Red Chris Mine. Ongoing support for environmental reporting activities as a component of the Trigger Response Plan for the Mine. Development of a Selenium Source Study for the Mine, as a component of the Permit Amendment.

**Dominion Diamond  
Ekati Corporation / Jay  
Project  
Northwest Territories,  
Canada**

Detailed assessment of the geochemical characteristics of mine rock and processed kimberlite from a proposed diamond mine in the Northwest Territories using existing geochemical dataset with several years of site testing and monitoring data. In addition, a project specific geochemical testing program was developed to confirm the characteristics of materials from the Jay Project.

The results of geochemical testing were used as input to the engineering design for the waste rock storage area design, including the development of geochemical criteria for waste rock management and deposition.

**Eldorado Gold Corp. /  
Mine  
Romania**

Tailings geochemical characterization, evaluation of existing results of geochemical characterization of waste rock, and development of water quality predictions in support of environmental permitting and engineering design.



**De Beers Canada Inc. /  
Gahcho Kue Project**  
Northwest Territories,  
Canada

Detailed assessment of the geochemical characteristics of mine rock and processed kimberlite from a proposed diamond mine in the Northwest Territories. Developed a geochemical testing program to evaluate metal leaching potential in site specific conditions, including specialized long-term leach tests and detailed mineralogical analysis. Tasks also included derivation of mine rock and processed kimberlite runoff and seepage source terms into the water quality model for the project.

A geochemical characterization plan was developed to provide recommendations for geochemical classification and monitoring of waste rock during operations. The geochemical characterization plan is a key component of the mine rock management plan for the project.

**De Beers Canada Inc. /  
Snap Lake Project**  
Northwest Territories,  
Canada

Ongoing evaluation of geochemical issues relating to Acid Rock Drainage (ARD) and metal leaching at an operational underground diamond mine. Bi-annual site visit for the purpose of assessment of construction materials for potential ARD, evaluation of seepage quality and source underground, and evaluation of surface seepage and drainage sources. Additional work includes compilation of information and evaluation of geochemical issues for the yearly Acid Rock Drainage (ARD) monitoring report.

Prepared the Metal Leaching / Acid Rock Drainage Plan for the Water License Update based on the results of baseline (pre-mining) and operational geochemical monitoring data.

**Fortune Minerals Ltd. /  
NICO Project**  
Northwest Territories,  
Canada

Detailed assessment geotechnical characteristics of waste rock and tailings from a proposed cobalt, copper, bismuth and gold underground and open pit mine in the Northwest Territories. Developed and implemented laboratory and field scale studies to assess the acid generation potential and metal leaching potential (specifically arsenic) of waste rock, ore and tailings for the purpose of input to site designs and environmental studies. Developed site water quality predictions for the purpose of evaluating the effect of the mine site on receiving water quality.

In collaboration with a large, multi-disciplinary team of engineers and environmental specialists, assisted with preparation of management plans for the project to support the water license phase of the project. Developed a Mine Rock Management Plan for the project, and provided input to the Conceptual Closure and Reclamation Plan and Co-Disposal Facility Plan.

**Alamos Gold Inc. / Agi  
Dagi and Kirazli  
Projects**  
Turkey

Preparation of water quality source terms for seepage and runoff from mine site facilities for input into a geochemical attenuation model to evaluate the effect of mine site seepage on groundwater. Models were completed for the Kirazli and Agi Dagi project areas, respectively. Multi-disciplinary model reports were prepared for the respective project areas, with input from multiple modeling teams, including unsaturated flow modelling, hydrogeological modelling and water balance modelling for the project. The reports were submitted as a component of the environmental impact assessments for the projects.



## Resumé

KRISTIN SALZSAULER

**Kinross Gold USA Inc.  
/ Buckhorn Mt. Project**  
Okanogan County,  
Washington, United  
States

Geochemical modelling and authoring of technical documents in support of a proposed project near Republic, Washington. Tasks include synthesis of past studies, compilation of static and kinetic testing results, and geochemical modelling and interpretation in support of engineering studies. The results of geochemical characterization were used to develop the initial rock classification criteria for the Mine. Additional work includes development of soil-metal partition coefficients and assessment of attenuation capacity of soils at proposed mine water infiltration site, and assistance in the development of technical reports and site maps related to geological and hydrogeological conditions. Provided input to the Development Rock Management Plan, and worked closely with the client to amend the Development Rock Management Plan based on the results of operational monitoring.

**Compañía Minera  
Antamina**  
Antamina, Peru

Ongoing assessment of the geochemical characterization of waste rock and tailings at an operating open pit copper zinc mine for the purpose of refinement of operational criteria and input to site designs.

Developed recommendations for the revision of the geochemical classification criteria of waste rock at the Project based on the results of operational monitoring.

Development of pit lake water quality predictions as a component of the Closure Plan update for the Project.

**Aurora Energy  
Resources / Michelin  
Project**  
Labrador, Canada

Design and implementation of a sampling and analysis program for the geotechnical characterization of waste rock and tailings from two open pit at a proposed uranium mine in Labrador, Canada. Results of geochemical characterization were summarized with respect to acid generation and metal / radionuclide leaching potential of waste rock and tailings.

**Khan Resources/  
Dornod Uranium  
Project**  
Mongolia

Design of a waste rock and tailings sample collection and analysis program for the purpose of completing a geochemical characterization study in support of screening studies, pre-feasibility studies, feasibility studies, and the socio-environmental impact assessment (SEIA) for the Dornod Uranium Project. Results of geochemical characterization were evaluated with respect to acid generation potential and metal/ radionuclide leaching potential for the purpose of consideration in site designs.

**Cameco Corp. /  
McArthur River Mine**  
Northern Saskatchewan,  
Canada

Collection of waste rock for static and kinetic testing in order to affirm the geochemical characteristics of stockpiled waste rock intended for reuse for site infrastructure.

**Encana Corporation /  
Larado Uranium  
Tailings Site  
Characterization**  
Uranium City,  
Saskatchewan, Canada

Geochemical site characterization of abandoned uranium mill tailings near Uranium City, Saskatchewan. Project work included extensive sampling of tailings material to delineate the geochemical characteristics of tailings material across the deposit, collection of water samples from the tailings and nearby bodies of water, and interpretation and compilation of this information into technical documents. Recent work includes an assessment of the sources and sinks of contaminants of concern on site, including arsenic, selenium, molybdenum and uranium.



## Resumé

KRISTIN SALZSAULER

**Eldorado Gold Corp. /  
Efemçukuru Mine**  
Izmir, Turkey

Geochemical characterization and interpretation of acid generation and metal leaching potential of mine waste materials for a proposed underground mine in support of an Environmental Impact Assessment. Project work included compilation and interpretation of static and kinetic testing results, and developing water quality predictions in order to comply with Turkish EIA requirements.

**Eldorado Gold Corp. /  
Kisladag Mine**  
Izmir, Turkey

Selection of samples from a large database to spatially and compositionally represent waste material to be extracted from a proposed open pit mine. Project work also involved support in identifying a laboratory to carry out static and kinetic tests. Samples were selected to comply with recommendations in Price (1997).

**North American  
Palladium /  
Shebandowan Mine**  
Thunder Bay, Ontario

Design of waste rock sample collection and analysis program at a proposed nickel mine. Results of geochemical characterization used to evaluate the acid rock drainage and metal leaching potential of waste rock, and to provide recommendations for ongoing testing.

**Cobre Mining  
Company / Hanover  
Empire Zinc Mine Area**  
Hanover, New Mexico

Collection of waste rock at the historic Hanover Empire Zinc mine site for static and kinetic testing in order to affirm the geochemical characteristics of aged waste rock stockpiles. Work has included mapping and sampling of surficial material in waste rock stockpiles, as well as test-pitting to confirm homogeneity at depth. Interpretation of the geochemical characteristics of stockpiled material will define the usability of this material for site remediation.

**Cobre Mining  
Company / Abandoned  
Shafts and Adits**  
Hanover, New Mexico

Collection of waste rock from waste rock piles associated with abandoned shafts and adits on historic claims owned by the Cobre Mining Company. Sampling was undertaken to confirm geochemical characteristics of aged waste rock stockpiles. Work has included mapping and sampling of surficial material in waste rock stockpiles. Interpretation of the geochemical characteristics of stockpiled material will define the usability of this material for site remediation.

**Minefinders  
Corporation Ltd. /  
Dolores Project**  
Northern Mexico

Geochemical characterization and interpretation of acid generation and metal leaching potential of mine waste materials for a proposed open pit mine. Project work included compilation and interpretation of static and kinetic testing results, and developing a water quality model to determine the final pit lake water quality for permitting and treatment purposes.

**Continental Minerals,  
Xionggun Project**  
Tibet, China

Pit lake water quality model in support of environmental impact studies for a proposed mine in Tibet. Geochemical modelling was conducted to predict the evolution of pit lake water quality evolution for a number of years post-closure, taking in consideration the effects of secondary mineral precipitation, adsorption and atmospheric interaction on ultimate pit lake water quality. Discharge water quality from the various mine components was assessed for the purpose of development of post-closure mitigative options.

**Newmont Ghana Gold  
Limited / Akyem,  
Subika and Apensu  
Pits**

Pit lake water quality model in support of closure planning for three open pits in Ghana. Geochemical modelling was conducted to predict pit lake water quality evolution on a five year basis, taking in consideration the effects of secondary mineral precipitation, adsorption and atmospheric interaction on ultimate pit lake water quality. Discharge water quality compared predicted discharge quality NGGL standards.



## Resumé

KRISTIN SALZSAULER

**Science Advisory Board**

British Columbia,  
Canada

Preparation of technical report summarizing development, use and modification of metal-partitioning coefficients for the purpose of generating site specific soil standards.

**Stimson Lumber / NorPetro Site**

Anacortes, Washington,  
United States

Installation of two monitoring wells for the purpose of delineating a contaminant plume at a former refinery using a sonic drill rig.

**City of Dallas / ASR**

Dallas, Oregon, United States

Interpretation of the general hydrogeochemistry and geochemical modelling of the effects of mixing source water and ground water in an aquifer storage and recovery system. Geochemical modelling included assessing the effects of metal sorption on aquifer materials.

**Monsanto Elemental Phosphorus Production Plant**

Soda Springs, Idaho,  
United States

Yearly water quality sampling for the Monsanto Elemental Phosphorus Plant NPL facility in Idaho. Tasks included the collection and interpretation of analytical data and authoring of the yearly technical report.

## PROFESSIONAL AFFILIATIONS

Professional Geoscientist, Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists (Canada)

Professional Geologist, Association of Professional Engineers and Geoscientists of the Province of British Columbia (Canada)

## PUBLICATIONS

Salzsauler, K., De Vos, K., and Schryer, R. 2012. Use of Exploration, Laboratory and Site-Specific Data for the Purpose of Mine Rock Classification, NICO Gold-Cobalt-Bismuth-Copper Project, Northwest Territories, Canada. Poster presentation at the 9th ICARD, Ottawa, Canada 2012.

Herrell, M.K., Salzsauler, K.A., McRae, C. A Practical Application of Mass-Balance Methods for Predicting Mine Drainage Water Quality – Climate Influences and Best Practices. Poster presentation at the 9th ICARD, Ottawa, Canada 2012.

Vandenberg, J., Lauzon, N., Prakash, S., and Salzsauler, K. 2011. Use of water quality models for design and evaluation of pit lakes. In: McCullough, CD (Ed) 2011 Mine Pit Lakes: Closure and Management, Perth, Australia, Australian Center for Geomechanics. p 63 - 80.

Salzsauler, K. and Verburg, R. 2009. Mine water quality predictions for permitting and engineering design at an underground gold mine. Paper presented at the 2009, Securing the Future and 8th ICARD, June 22-26, 2009, Skelleftea, Sweden.





Herrell, M.K., McRae, C., Salzsauler, K.A., Waples, J.S., 2009. Practical Application of Accelerated Methods of Acid Rock Drainage and Metal Leaching Prediction of Mine Materials. Paper presented at the 2009, Securing the Future and 8th ICARD, June 22-26, 2009, Skelleftea, Sweden.

Salzsauler, K.A., Sidenko, N.V., and Sherriff, B.L. 2005. Arsenic mobility in alteration products of sulfide-rich, arsenopyrite-bearing mine wastes, Snow Lake, Manitoba, Canada. *Applied Geochemistry*. 20: 2303 - 2314.

Flemming, R., Salzsauler, K., Sherriff, B. and Sidenko, N. 2005. Identification of scorodite in fine-grained, high-sulfide, arsenopyrite mine waste using micro X-ray diffraction ( $\mu$ XRD). *Canadian Mineralogist*. 43:1243 - 1254.

Salzsauler, K.A., Sidenko, N.V., Sherriff, B.L. 2004. Arsenic in solution and secondary phases in sulfide mine waste, Snow Lake, Manitoba, Extended Abstracts of Water-Rock Interaction-11 Symposium, Saratoga Springs, New York.