



29th International Applied Geochemistry Symposium IAGS2022

Facing the challenges of today using applied geochemistry

Sunday October 23rd – Friday October 28th, 2022

Viña del Mar, Chile

Held in memory of our friend and colleague Dr. Peter Winterburn

SCIENTIFIC PROGRAM

Monday, October 24th – Room Gran Caracola

Technical Session 1: Exploration geochemistry: present and future challenges. Chair: Carmina Jorquera.

Keynote Lecture

Fundamental Laws of Geochemical Elements and Anomaly Recognition for Mineral Exploration. **Qiuming Chen, Sun Yat-Sen University, China**

Oral Presentations

Stream sediment geochemical and indicator mineral signatures of the Casino porphyry Cu-Au-Mo deposit, Yukon, Canada. **Beth McClenaghan, Geological Survey of Canada, Canada.**

Detrital zircon chemistry, a tool for exploring copper porphyries: the Cerro Colorado district case study. **Joaquín Copaja, BHP, Chile.**

Extending the size of the alteration footprint around the Hemlo Au deposit, N. Ontario: application of epidote and chlorite mineral chemistry in Archean greenstone terranes. **Pete Hollings, Lakehead University, Canada.**

Discrimination of porphyry-related epidote using mineral chemistry in the Andes of central Chile. **José Piquer, Universidad Austral de Chile, Chile.**



Actinolite as a proxy for characterizing the evolution of Iron-Oxide Copper Gold deposits. **Irene del Real, Universidad Austral de Chile, Chile.**

Fluid Flashing and Polymetallic Vein Formation Above a Shallow Porphyry Pluton: Petrographic Evidence from the Sunnyside Deposit, Colorado, USA. **Mario Guzmán, Colorado School of Mines, United States.**

Geochemical Exploration for Critical Metals in The Carboniferous Maritimes Basin, Eastern Canada. **Peter Rogers, Independent Consultant, Canada.**

Base metals and PGE behavior in slab-decoupled oceanic felsic melts: insights from the Fatu Kapa area (NW Lau back-arc basin, SW Pacific). **Aurélien Jeanvoine, Seoul National University, France.**

Magmatic sulfide-bubble compound drops are crucial for the formation of Cu-rich massive sulfide ores in oceanic settings. **Aurélien Jeanvoine, Seoul National University, France.**

Newmont Geochemistry, the Untold Story. **Simon Marshall, Newmont, Australia.**

Finding a Walton like Zn deposit; a case study using deep penetrating geochemical exploration methods Maritimes Basin, Eastern Canada. **Peter Rogers, Independent Consultant, Canada.**

Microbial biosensors of buried mineralization. **Bianca Iulianella Phillips, University of British Columbia, Canada.**

The challenges of geochemical exploration in the subarctic terrain of the Scandinavian Peninsula. **Joachim Albrecht, Boliden Mineral AB, Sweden.**

Monday, October 24th – Room Gran Estrella

Technical Session 8: Linking geology and geochemistry to viticulture and wine - 1st. IGVWS2022. Chair: Pamela Castillo

1st IGVWS Keynote Session (to be announced)

Oral Presentations

Influences of geology, mineralogy and geochemistry in viticulture and Terroir: An Introduction. **Brian Townley, Universidad de Chile, Chile.**

To be announced. **Pamela Castillo, Universidad de Concepción, Chile.**



To be announced. **Ignacio Serra, Universidad de Concepción, Chile.**

Geochemical and Mineralogical Changes during Soil Development: Preliminary Study of a Brunisolic Soil from Nova Scotia. **Clifford Stanley, Acadia University, Canada.**

Application of a weak leach as a measure of bioavailability in vineyard soils for management of soil nutrient levels in British Columbia, Canada. **Hugh de Souza, Geochemical Consultant, Canada.**

Contributions for IGVWS2022 still open until October 3rd

Tuesday, October 25th – Room Gran Caracola

Technical Session 1: Exploration geochemistry: present and future challenges. Chair: Carmina Jorquera.

Oral Presentations

Pathfinder dispersion in fractures above the Oberon gold deposit, Tanami region, Northern Territory, Australia. **Collette Pilsworth, Queen's University, Canada.**

Application of Geogas survey to mineral exploration in loess plateau, eastern Gansu. **Mingqi Wang, China University of Geosciences, China.**

Impacts of environmental variables on biogeochemical results - orientation survey in the Peräpohja Belt, northern Finland. **Maarit Middleton, Geological Survey of Finland, Finland.**

Tectonic Controls of Mineralization in the Central Atacama Desert: The Antofagasta Transect. **Constantino Mpodosis, Independent Consultant, Chile.**

Technical Session 2: New field portable technologies: improving the analysis and turnaround times in exploration, Chair: Andrew Menzies.

Oral Presentations

New applications of Portable XRF (pXRF) in mineral exploration. **Edgardo Jiménez, Evident Olympus, Chile.**

Comparative pXRF and ICP ES/MS data for regional till samples: East Arm of Great Slave Lake, NT, Canada. **Ross Knight, Geological Survey of Canada, Canada.**



Re-inventing the laboratory for the digital age: high resolution XRF core scanning to characterize the distribution of critical metals. **Hugh de Souza, Geochemical Consultant, Canada.**

Getting the most out of real-time portable XRF; The TruScan Solution. **Vicente Piel, Boart Longyear Chile, Chile.**

Cathode to phyllode via in situ mode - Field use of pXRF to analyse pine needles in regional and deposit scale geochemical mapping in the Cobar Basin. **David Cohen, University of New South Wales, Australia.**

Rapid and robust: An assessment of Handheld XRF in the field settings. **Kathrin Schneider, Bruker Nano GmbH, Germany.**

Field analysis of low level gold using novel detectORETM technology. **Melvyn Lintern, Portable PPB Pty Ltd., Australia.**

A population-based approach to pXRF calibration to provide near-time litho geochemistry for guiding drilling decisions at Carlin-type gold projects. **James Buskard, Nevada Exploration Inc., Canada.**

Tuesday, October 25th – Room Gran Estrella

Technical Session 5: Environmental Geochemistry: Closing the gap for sustainable mining and development / Mine tailing revalorization (UNESCO-IGCP682) Chair: Katja Deckart

Keynote Lecture

Sourcing of critical elements and industrial minerals from mine waste/ore deposits – The role of Geochemistry. **Bernhard Dold, SUMIRCO, Germany.**

Oral Presentations

Reactive transport modelling of a multistage copper leaching experiment: Implications for *in situ* recovery. **Pablo Ortega Tong, University of Western Australia, Australia.**

Improving and diversifying mine tailing revalorization through detailed mineralogical and geochemical analysis at a current tailings recovery plant (Minera Valle Central, Chile). **Sebastián García, Universidad de Chile, Chile.**

Column leaching of oil sands froth treatment tailings: Comparison of capping scenarios. **Nicholas Utting, CanmetENERGY Devon, Canada.**



Electrokinetic *in situ* leaching of copper. **Pablo Ortega Tong, University of Western Australia, Australia.**

Environmental geochemistry of seven fluvial systems in Chile: Lluta, Copiapó, Huasco, Limarí, Rapel, Valdivia and Aysén river basins. **Juan Pablo Lacassie, Servicio Nacional de Geología y Minería, SERNAGEOMIN, Chile.**

Technical Session 7: Isotopic Geochemistry: New uses in applied Geochemistry. Chair: Verónica Oliveros

Oral Presentations

Iron isotope constraints on the release of arsenic from sediments in the Mekong Delta, Cambodia. **Kosei Yamaguchi, Toho University, Japan.**

Sr-Nd-Pb isotopes from the Chollay Plutonic Complex, a Triassic non-compressive arc batholith of the SW margin of Gondwana. **Verónica Oliveros, Universidad de Concepción, Chile.**

Application of Isotope Exchange Techniques to Studies of Trace-Element Binding by Minerals and Soils. **Malcolm Clark, Southern Cross University, Australia.**

The application of U-Pb age dating of *in-situ* carbonates by LA-ICP-MS to resolve timing of fluid flow in the Michigan Basin in southern Ontario. **Chelsea N. Sutcliffe, Teck Resources Ltd., Canada.**

Isotopic and geochemical tools to monitoring ecosystem services provided by native forest: the case study of the Nonguén National Park in the coastal area of south-central Chile. **Verónica Oliveros, Universidad de Concepción, Chile.**

Thursday, October 27th – Room Gran Caracola

Technical Session 3: Big Data: Squeezing multi-element geochemical data by means of data science and self-learning techniques. Chair Álvaro Egaña

Keynote Lecture

Data Digs Deeper: using data science to transform geochemical understanding into discovery. **Britt Bluemel, GoldSpot Discoveries, Canada.**



Oral Presentations

Integration of Texture and SWIR Spectroscopy with Geochemistry to Improve Machine-driven Classification of Geological Characteristics. **McLean Trott, Queen's University, Canada.**

Petrology & Litho-geochemistry of the Wildcat Brook Mo-W deposit, Charlotte County, New Brunswick, Canada: Insights into Log-Ratio Analysis. **Clifford Stanley, Acadia University, Canada.**

Mineral Resource Prediction Using Advanced Data Analytics and Machine Learning Based on Stream Sediment Geochemical Data, British Columbia. **Dennis Arne, Telemark Geosciences, Australia.**

New technologies capable to optimize the big-data generated in exploration; The symbiotic case of TruScan and TruVision. **Vicente Piel, Boart Longyear Chile, Chile.**

Conserved Element Ratio Analysis in Litho-geochemistry: From Scatterplots to Spider Diagrams. **Clifford Stanley, Acadia University, Canada.**

Using machine learning to facilitate the analysis of multi-element geochemistry datasets in the Abanico and Farellones formations in Central Chile (32°-33°S). **Abigail Jackson-Gain, Universidad de Chile, Chile.**

Multi-digestion regional rock geochemistry of Variscan granites and elvans in SW England: delineation of composite intrusions and Sn-Li potential. **Charlie Moon, Moon Geology, Great Britain.**

Gold recovery prediction using geostatistical and machine learning tools. **Felipe Navarro, Universidad de Chile, Chile.**

Rapid Estimator of geometallurgical variables based on hyperspectral images and a Bayesian processing scheme: Methodology and case studies. **Alejandro Ehrenfeld, Alges, Chile.**

Technical Session 6: Water and hydrogeochemistry: Challenges in exploration, mining, and sustainable development. Chair: Luciano Achurra

Oral Presentations

Stream Sediment Sample Catchment Analysis using Open-Source Tools. **Matthew Bodnar, GoldSpot Discoveries, Canada.**



Monitoring the water quality of pit lakes and tailings ponds using Google Earth Engine. **Oscar Benavente, SRK Consulting, Chile.**

Thursday, October 27th – Room Gran Estrella

Technical Session 4: Geochemistry applied to mineral characterization for geological, geometallurgical and resource modeling. Chair: Brian Townley.

Oral Presentations

Mapping porphyry alteration more specifically: integrating geochemistry and hyperspectral imaging data at the Caspiche Porphyry, Chile. **Sam Scher, LKI Consulting, United States.**

Multi-scale, multi-modal and multi-dimensional workflow for the rapid characterization of exploration drill cores – a Au-Co case study from Finland. **Andrew Menzies, Bruker Nano Analytics GmbH, Germany.**

Critical Minerals: An opportunity to be considered in Chile. **José Cabello, Sociedad Geológica de Chile, Chile.**

Potential sources of Cobalt in Chile: from primary by-products to tailing reprocessing. **Brian Townley, Universidad de Chile, Chile.**

Geometallurgy of Cobaltiferous Copper Ores of the Chilean Iron Belt. **Romke Kuyvenhoven, MDE Minerals Consulting, Chile.**

Alteration Zonation Patterns Characterized by Hyperspectral Data within Orogenic Gold Deposits of the Ahafo South Camp, Sefwi Granite-Greenstone Belt, Ghana. **Jeffrey Bigelow, Newmont, Australia.**

Applied Mineralogy techniques used to verify the normative mineralogy modeling based on the geochemical data: The strength and limitations of the common mineralogy techniques. **Mahdi Ghobadi, Activation Laboratories, Canada.**

Transformational Ore Body Knowledge Workflows: The data behind the vision. **Ayesha Ahmed, Teck Resources Ltd., Canada.**

The Role of Geochemistry and Geometallurgy in Sustainable Resource Development. **Pim van Geffen, CSA Global, an ERM Group Company, Canada.**



REE Deposits in South-Central Chile: An exploration overview of Ion- Adsorption Deposits. **Martín Marquardt, GEOK Ltda., Chile.**

Friday, October 28th – Room Gran Caracola

Technical Session 6: Water and Hydrogeochemistry: Challenges in exploration, mining, and sustainable development. Chair: Luciano Achurra

Oral Presentations

Hydrogeochemistry of mine tailings from a carbonatite-hosted Nb-REE deposit, Oka, Québec, Canada. **Alexandre J. Desbarats, Natural Resources Canada, Canada.**

The Geochemical Anomalies of the Turbio River, Coquimbo Region, North Central Chile, and its Environmental and Economic Bearings. **Ricardo Oyarzún, Universidad de La Serena, Chile.**

Geochemical signatures of porphyry deposits in ground and stream waters: erosion, enrichment, and alteration. **James Kidder, Geological Survey of Canada, Canada.**

Hydrogeochemical Modeling of Waste Rock Dumps on an Early-Stage Mine Development: Uncertainties and Opportunities. **Jaime Rivera, SRK Consulting, Chile.**

High-altitude Chilean hot springs: hydrogeochemistry characterization and biogeological relationships in Lirima, a window to early Earth. **Pablo Paquis, Universidad Católica del Norte, Chile.**

Geothermal fluids and lithium deposits in the salt flats: An assessment of their association at Laguna Verde, Atacama Region, Chile. **Mohammad Ayaz Alam, Universidad de Atacama, Chile.**

Friday, October 28th – Room Gran Estrella

Technical Session 4: Geochemistry applied to mineral characterization for geological, geometallurgical and resource modeling. Chair: Brian Townley

Oral Presentations

The formation of the Exótica deposit at Chuquicamata, Chile. **Bernhard Dold, SUMIRCO, Germany.**



Characterizing the geochemical and geophysical properties of an orebody to select the optimal sensor for sensor-based sorting. **Rob Millar, Saskatchewan Research Council, Canada.**

Meteorite classification using QEMSCAN: First results for ordinary chondrites from the Atacama Desert. **Millarca Valenzuela, Universidad Católica del Norte, Chile.**

Technical Session 9: Analytical geochemistry technologies and quality control assurance / Quality control Chair: To be announced

Oral Presentations

Standardless quantification with micro-XRF – are we there yet?. **Falk Reinhardt, Bruker Nano GmbH, Germany.**
Blank Analyses in Geochemical QAQC: How to Get Something from Nothing. **Clifford Stanley, Acadia University, Canada.**

Certified Reference Material Accepted Values and Tolerances: Some Idle Thoughts and an Idea or Two. **Clifford Stanley, Acadia University, Canada.**

POSTER PROGRAM

Technical Session 1: Exploration Geochemistry: Present and Future Challenges

Sediment geochemistry of the La Serena Sheet, Coquimbo region. **Felipe Astudillo, Servicio Nacional de Geología y Minería, SERNAGEOMIN, Chile.**

Preliminary results of the Sediment Geochemical Database of the Taltal Sheet, Antofagasta and Atacama Regions, Chile. **Pablo Oliva, Servicio Nacional de Geología y Minería, Chile.**

The application of physical and chemical characteristics of tourmaline from stream sediments: a novel tool in the exploration for porphyry Cu-Au-Mo deposits. **Beth McClenaghan, Geological Survey of Canada, Canada.**

Advanced PIMs Analysis: Case Study in the Domeyko Cordillera Comparing Optical and Automated Methods. **Marcelo Vega, Teck Resources Ltd., Chile.**

Provenance Analysis of Placer Gold from Pureo Area, Southern Chile Coastal Cordillera. **Pablo Becerra, Universidad Austral de Chile, Chile.**



Distribution of Rare earth Elements in drainage sediments of the Arica and Parinacota and Tarapacá regions. Northern Chile: preliminary results. **Rafael Mardones, Servicio Nacional de Geología y Minería, SERNAGEOMIN, Chile.**

Evaluation of the metallogenic and exploratory potential of the Western sector of the Collahuasi district, northern Chile. **María Cecilia Izquierdo, Universidad Arturo Prat, Chile.**

Technical Session 2: New Field Portable Technologies: Improving the analysis and turnaround times in exploration

Investigating sources of data variability in short-wave infrared and visible to near infrared spectroscopy. **McLean Trott, Queen's University, Canada.**

Quantifying the invisible: pXRF analyses of three boreholes. **Ross Knight, Geological Survey of Canada, Canada.**

Technical Session 4: Geochemistry applied to mineral characterization for geological, geometallurgical and resources modeling

Phenomenological approach to understanding geometallurgical properties from geochemistry and geotechnical properties. **Alexis Pereira, Universidad de Chile, Chile.**

Types of wollastonite, and identification of host skarns and their protoliths at the St. Lawrence Wollastonite Skarn, SE Ontario. **Andrés Canales, Universidad del Desarrollo, Chile.**

Technical Session 5: Environmental Geochemistry: Closing the gap for sustainable mining and development / Mine Tailing revalorization (UNESC-IGCP682)

Environmental impact caused by the collapse of the Las Palmas Tailing Dam based on geochemical analysis of natural and tailing sediments. **María Paz Muñoz-Arzola, Universidad Mayor, Chile.**

Copper mobility in soils affected by anthropogenic activities in northern and central Chile. **Daniela García, Universidad Católica del Norte, Chile.**

Geochemical assessment of sediments around tailings to determine the pollution contamination by metals at the location of Alhué, Metropolitan Region, Central Chile. **Estefanía Muñoz, Universidad Santo Tomás, Chile.**



Technical Session 6: Water and hydrogeochemistry: Challenges in exploration, mining and sustainable development

Valuable elements in geothermal systems in Central-Southern Chile: preliminary selection of valuable elements and conditioning geological factors. **Belén Muñoz, Universidad Santo Tomás, Chile.**

Can Chile extract Li from geothermal brines? Statistical approach to determine geochemical factors in Li enrichment. **Alejandra Acuña, Universidad Santo Tomás, Chile.**

A coupled isotopic-geochemical assessment of hydrological dynamic in headwater Andean basins in north-central Chile. **Ricardo Oyarzún, Universidad de La Serena, Chile.**

Brine exploration from the geothermal complex of the Liquiñe-Ofqui fault zone as a response to power generation. **Felipe Ruiz, Universidad Santo Tomás, Chile.**

Technical Session 7: Isotopic Geochemistry: New uses in applied geochemistry

Brine exploration from the geothermal complex of the Liquiñe-Ofqui fault zone as a response to power generation. **Carla Barros, Universidade Federal do Rio Grande Do Sul, Brazil.**

Viña del Mar, Chile, September 2022