Porphyry Deposits of Southern British Columbia
MUN-SEG Annual Field Trip

MUN-SEG 2025 Field Trip Report
April 27th - May 5th, 2025

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Sponsors

We wish to express our sincere gratitude to our sponsors who made this field trip possible. Funding was received from the **Society of Economic Geologists** (Stewart R. Wallace Fund), the **Prospectors and Developers Association of Canada** (student field trip funding program), and generous local industry sponsors: **Altius Minerals** and **Maritime Resources.**

Overview

The goal of this field trip was to expose students to a wide range of base and precious metal deposits within Southern British Columbia. Porphyry copper deposits are critical contributors to the British Columbia (BC) economy. BC is Canada’s largest producer of copper with more than $2 billion generated annually from copper concentrate revenues won from BC porphyry copper deposits. This field trip provided students with the opportunity to study a variety of base and precious metal deposits and to gain hands-on experience and insight from local experts to better understand the local geology, mineralogy/mineralization, mining techniques, and environmental issues within each of the different mineral deposits. Students were able to apply any information learned during the proposed field trip to their ongoing geological research and throughout their future careers as aspiring geoscientists. This field trip will ultimately provide students from MUN-SEG to learn about historical, current, and future mining operations within British Columbia while also offering an excellent opportunity to learn about ongoing social, political, and environmental challenges faced by Canadian mining companies. Furthermore, students were given the opportunity to socialise and build professional relationships with members of the University of British Columbia SEG chapter as well as local academic and industry professionals.

Itinerary

April 27th: Travel day (St. John's-Kelowna)

Day 1 *(April 28th):* Visit to the New Afton mine (New Gold Inc.)

Day 2 *(April 29th):* Visit to the Highland Valley Copper mine (Teck Resources Corp.)

Day 3 *(April 30th):* Visit to the New Craigmont project (Nicola Mining Inc.)

Day 4 *(May 1st)*: Visit to the Copper Mountain mine (Hudbay Minerals Inc.)

Day 5 *(May 2nd)*: Review of the Tulameen ultramafic complex

Day 6 *(May 3rd):* Lillooet - Whistler geostops

Day 7 *(May 4th)*: Britannia mine museum and beer with UBC-SEG

Day 8 *(May 5th):* UBC-MDRU Facilities tour

May 5th-6th: Travel day (Vancouver-St. John's)

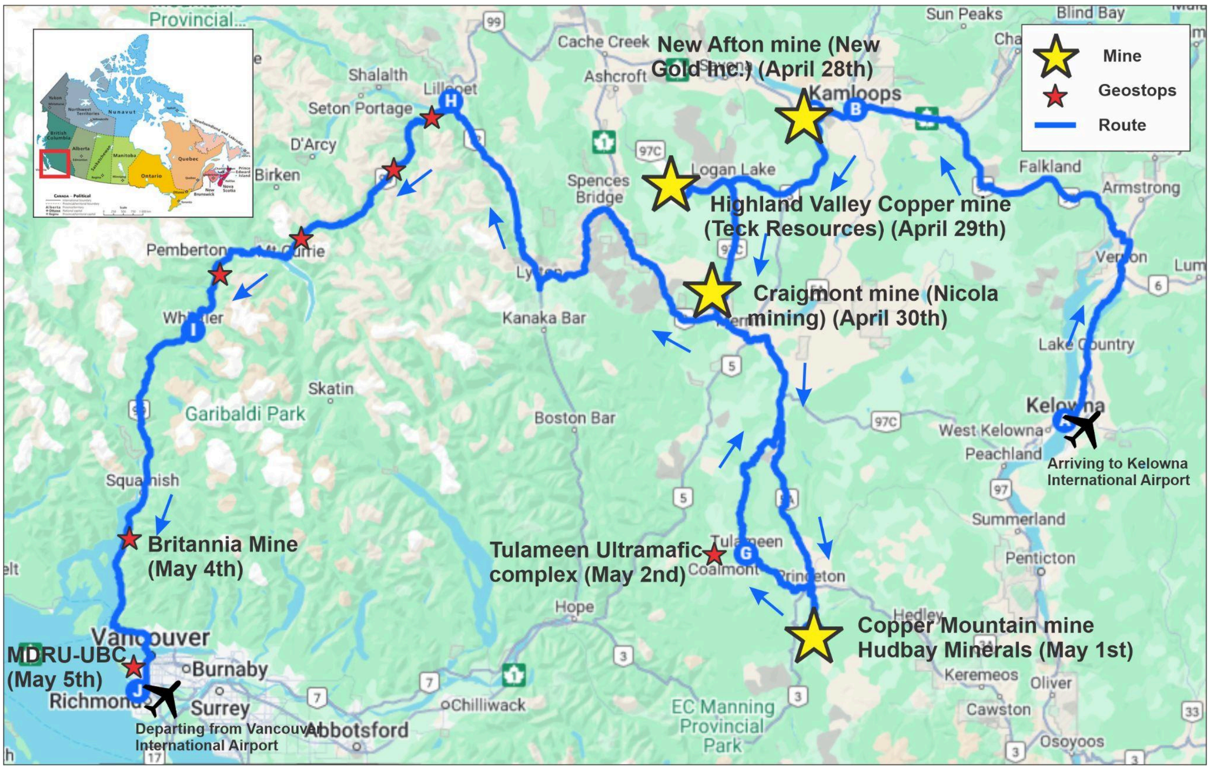

Figure 1. Location of the main places visited in the MUN-SEG 2025 Field Trip.

Daily Summaries

Day 1: *New Afton Au-Ag-Cu mine (New Gold)*

We started our field trip with a visit to the New Afton mine, located in Kamloops outskirts and owned/operated by New Gold Inc. After being introduced to the main in site safety measures, we took part in a processing facility tour, where we were able to take a look at the crushing, grinding, flotation and dewatering systems used for final concentrate production (**Figure 1A**). Afterwards, we went on a surface tour, mostly focused on providing an overview on the geotechnical management of historical and active tailings (**Figure 1B**).

Finally, we met the geology team at the core shack (**Figure 2**) where they provided a short overview on the local geology, focusing on the spatial distribution of the mineralized blocs. At New Afton, the Au-Cu deposit consists of 3 zones (Main zone, Hanging Wall zones, Eastern zones) comprising E-W subvertical zones of disseminations, stringers, and fracture filling sulphides within the Nicola Group and a slightly younger dioritic intrusion. Subsequent drill core examination complemented the geology presentation as the New Afton geology team kindly introduced us to the main mineralizing styles using 2 reference holes from the Main and Eastern zones.

Figure 1. Visit at New Afton mine: A) MUN-SEG students at the ore processing facility. B) Current tailings.

Figure 2. A) Gold flotation cell. B) MUN-SEG students at the core shack.

Day 2: *Highland Valley Copper mine (Teck Resources)*

On our second day in Kamloops, we visited the Highland Valley Copper mine owned by Teck Resources, this is roughly a 50 minutes drive from Kamloops. During the morning, John Ryan, geologist from Teck, received us on site and provided an overview of regional and local geology with focus on key alteration and mineralizing geochronological events. The Highland Valley district comprises four separate but genetically related large low grade hypogene porphyry Cu (± Mo) deposits (Bethlehem, JA, Valley-Lornex, and Highmont), hosted within the Late-Triassic, calc-alkaline Guichon Creek batholith.

After the geology presentation, we went to the core shack and had a look at a recently drilled hole mainly cutting the sodic-calcic alteration but with some ore grade intervals with chalcopyrite and bornite (**Figure 3**). In the afternoon, after reviewing the core, we received the PPE and headed for a tour through the Valley and Bethlehem pits (**Figure 4**). The HVC district is one of the longest-lived base metal districts in Canada and mineral extraction has occurred continuously for around 60 years and intermittently for more than a century.

We finished the day thanking John Ryan for the tour and his help in this visit and headed for a quick stop in Logan Lake where we had a closer look at a haul truck and some ore samples donated from the HVC mine to the district of Logan Lake.

Figure 3. Core shack visit: A) MUN-SEG students viewing the drillhole displayed on the table. B) Abundant quartz veining cutting the host rock with strong sodic-calcic alteration. C) Bornite bleb in a quartz vein.

Figure 4. MUN-SEG students at the Valley pit at the Highland Valley Copper mine.

Day 3: Craigmont Mine (Nicola Mining Inc.)

On April 30th, our group visited the New Craigmont Project, operated by Nicola Mining Inc., located in Lower Nicola, approximately 13 km from Merritt, British Columbia. The visit began with an overview of the regional and deposit-scale geology, presented by Will Whitty (VP exploration) and Warren Wegener (current President of the UBC-SEG Student Chapter), who also conducted a thorough safety briefing.

We were also joined by Vicente Garcia, Nicola Mining's newly appointed Senior Exploration Geologist and former SEG student member. During the presentation, Warren introduced his M.Sc. research project, supported by the Mineral Deposit Research Unit (MDRU) which focuses on the geological characteristics of the area and the potential for a bigger porphyry system underneath the historical Craigmont skarn.

Historically, mineralization at New Craigmont has been classified as Cu-Fe skarn-type. However, recent evidence suggests a possible porphyry-style component. This includes the presence of quartz-chalcopyrite veinlets and disseminated sulfides, which could indicate an extension of the mineralized system beyond traditional skarn boundaries. Following the presentation, Will and Warren led the group to the core shack, where we had the opportunity to examine representative core samples showcasing the mineralized intervals (**Figure 5)**.

Figure 5. Core shack visit: samples from drill holes displayed on the table.

The mineralization consists of mainly chalcopyrite and magnetite within a skarn assemblage, associated with basaltic rocks and Fe-bearing/rich siltstone and argillite. The mine isn't active and Will explained that most of the revenue comes from the processing of ore from different companies. A tour through the processing facilities was made, taking a closer look at the crushing, grinding and dewatering systems used for final concentrate production (**Figure 6A**).

Finally, the group visited an old pit (**Figure 6B**), where Warren and Will explained the mitigation and environmental procedures after the ending of production in pits. The MUN-SEG team had the chance to collect samples from abandoned ore in the area. We finished the day thanking Warren, Will and Vicente for the tour and their help in this visit and headed for our stance in Princeton.

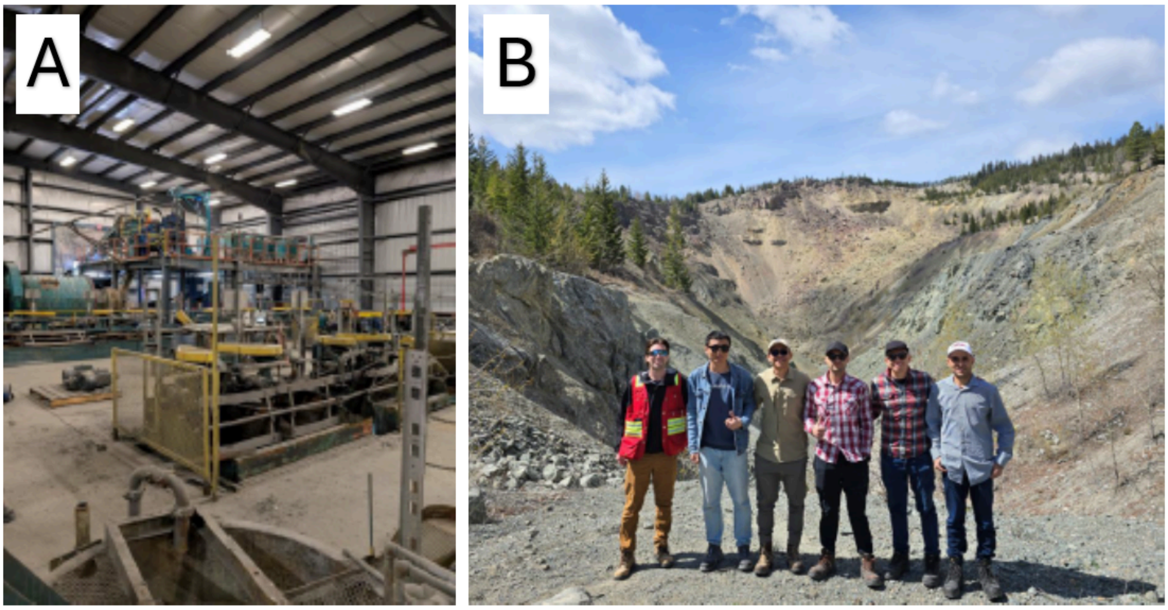

Figure 6. A. Processing facilities. B. MUN-SEG team in an old Craigmont pit.

Day 4: *Copper Mountain mine (Hudbay Minerals)*

On the morning of May 1st, our group visited the Copper Mountain site. Copper Mountain is located approximately 20 kilometres south of Princeton, British Columbia, in the Similkameen Valley. This open-pit mining operation includes a processing plant with a daily capacity of 45,000 tonnes. The plant uses conventional techniques including crushing, grinding, and flotation to recover copper concentrates, with gold and silver produced as by-products.

We were warmly welcomed by Neil Mankins, project geologist with Hubday and former student member of the Society of Economic Geologists (SEG), who served as our on-site guide. Our visit began with a safety briefing. Neil distributed personal protective equipment (PPE) and reviewed key safety procedures to ensure compliance with site protocols. He then provided an overview of the geological setting of the Copper Mountain deposit. We learned that the deposit is hosted in a sequence of volcanic rocks belonging to the Nicola Group, which are predominantly Late Triassic to Early Jurassic in age. The main lithologies include andesite, basaltic andesite, and tuffaceous units. Copper mineralization is primarily associated with these volcanic host rocks, but is also related to later intermediate intrusions—particularly granodioritic and dioritic porphyries. Following the introduction, we visited the drill core storage facility where we closely examined representative samples of mineralized core.

The mineralization style is dominantly vein-hosted and disseminated. The principal ore minerals observed include bornite, chalcopyrite, pyrite, pyrrhotite, and magnetite (**Figure 7**). The final part of our visit was an on-site observation of the open-pit mine (**Figure 8**) . There, we directly observed a prominent fault structure exposed within the pit wall (**Figure 9**). This provided excellent context for understanding the structural controls on mineralization. The emplacement and crystallization of the porphyritic intrusions, in combination with the structurally controlled fluid pathways, generated a high-temperature, medium-salinity hydrothermal system. Under a regime of multiphase deformation and episodic fluid boiling, this system led to the formation of a multi-centred, vein and disseminated-style copper-gold mineralization.

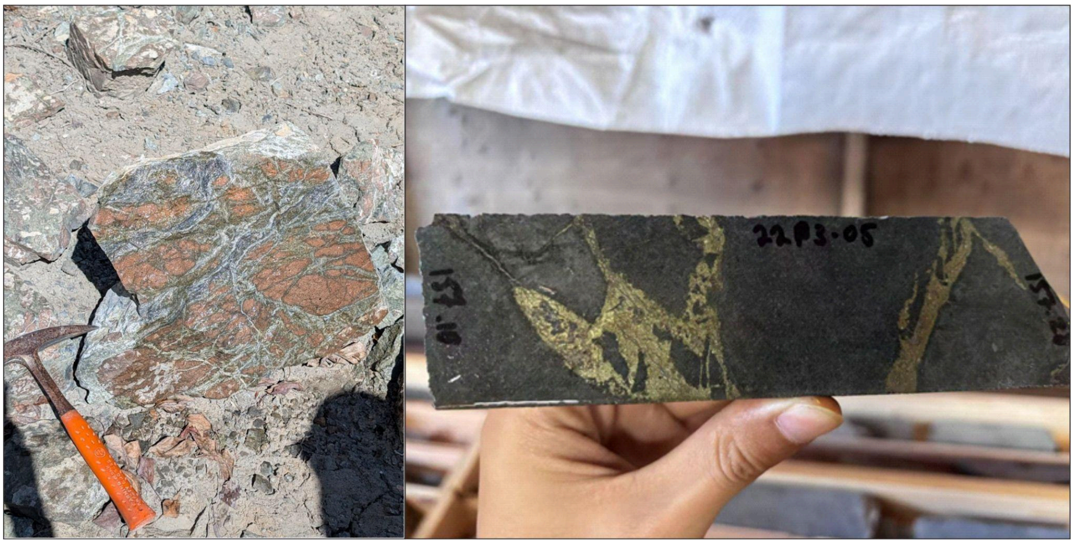

Figure 7. *Left:* Stockwork with potassic alteration at the Ingerbelle pit; *Right:* Chalcopyrite vein in drill core.

Figure 8. MUN-SEG students pictured at the Copper Mountain deposit.

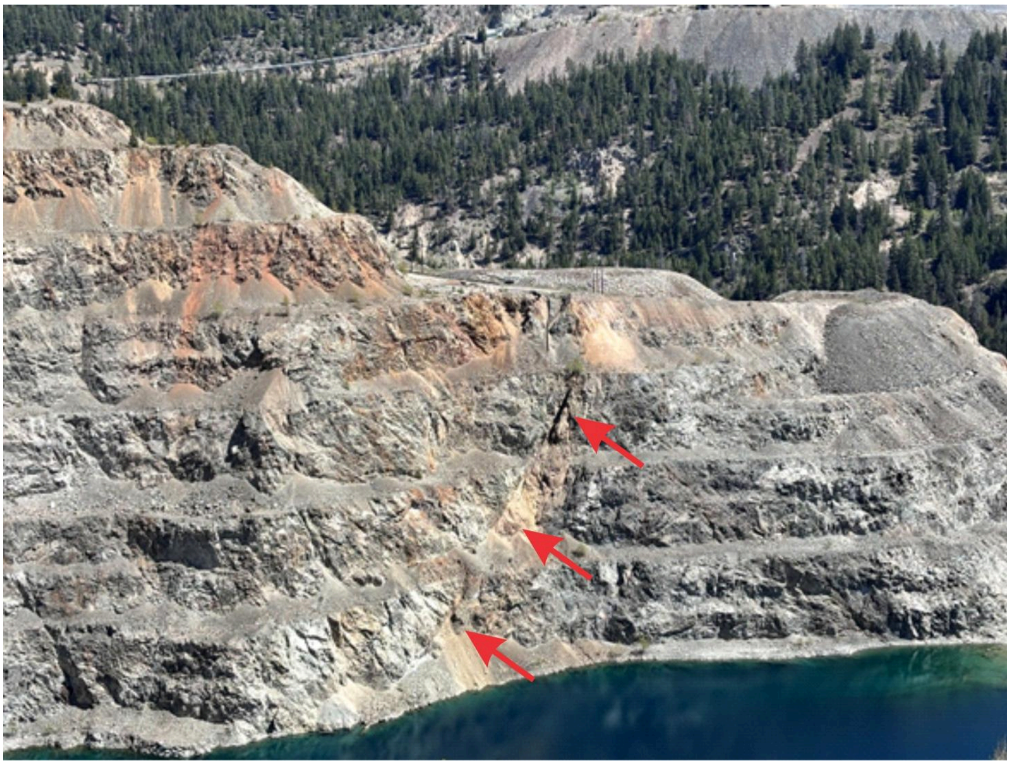

Figure 9. A prominent fault (red arrow) exposed within the pit wall.

Day 5: *Tulameen Ultramafic Complex*

After a busy day at Copper Mountain, we headed to Tulameen for a quick view of the Alaskan-type Tulameen Ultramafic Complex. This intrusion belongs to a class of ultramafic-mafic bodies emplaced in convergent margin or supra-subduction zone environments. This class of intrusions is gaining prominence as an exploration target for magmatic Ni-Cu and platinum group element (PGE) mineralization.

10 km west of the small town of Tulameen, we entered the complex that ranges in composition from a hornblende-rich gabbro towards a pyroxenite and a more ultramafic dunitic core (**Figure 10**). Our goal was to reach a chromitite near the Champion Cu-PGE zone but, unfortunately, a bridge on this road had been collapsed by a river avalanche, which stopped us from continuing on the road.

Figure 10. Dunite sample in the Tulameen River.

Day 6*: Structural and Stratigraphic Transect from Lillooet to Whistler, BC*

The map below (**Figure 11**) highlights the key geological stops made during our Day 6 transect from Lillooet to Whistler, BC. This route crosses a structurally complex segment of the southern Canadian Cordillera, where we examined major fault zones, metamorphic belts, and accreted terranes. Stops include exposures of the Mission Ridge Fault, transitions between the Bridge River Complex and the Cayoosh assemblage, and views of plutonic contacts and forearc basin deposits. These locations provided critical insights into the region's tectonic evolution and crustal architecture.

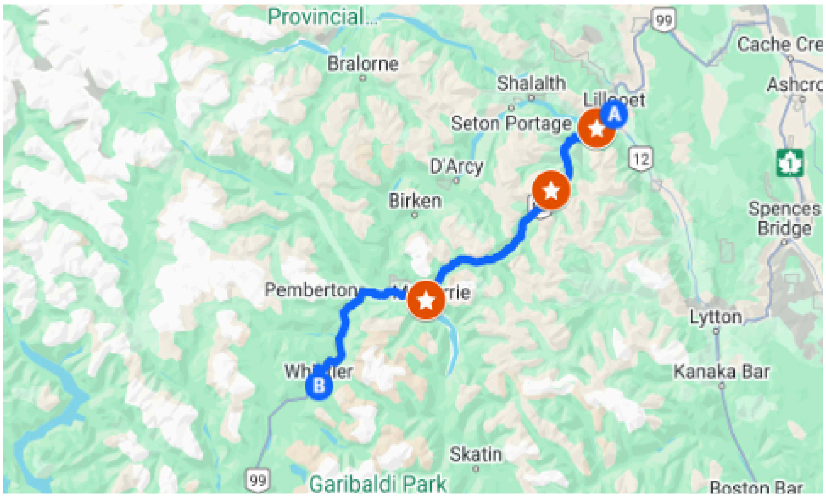

Figure 11. Transect between Lillooet and Whistler.

Stop 1: Mission Ridge Fault: Metamorphic Rocks in the Lower Plate

At this stop, we had a clear look at metamorphic schists located in the lower plate of the Mission Ridge Fault (**Figure 12**). These rocks have undergone multiple phases of deformation. One of the standout features was the southeast-plunging lineations, which point to right-lateral (dextral) shear, a hallmark of the Early Eocene tectonic activity in this region. This kind of deformation suggests that we were looking at rocks that were sheared deep in the crust during a period of significant crustal stretching or collapse. Looking out toward the surrounding peaks Mount Brew and the Cayoosh Range we could also see exposures of the Bridge River Complex and Brew Group.

Figure 12. Metamorphic schists in the lower plate of the Mission Ridge Fault.

Stop 2: Gott Creek Section: Transition Between Bridge River and Cayoosh Assemblages

At Gott Creek, we observed a stratigraphic transition zone where lithologies of the Bridge River Complex grade upward into the overlying Cayoosh assemblage (**Figure 13**). Outcrops on both sides of the bridge revealed finely laminated, foliated dark grey siliceous siltstone, recrystallized chert, talc-chlorite schist, greenschist, and thin marble layers. These rocks document a facies transition from greenstones and pelagic sediments typical of the oceanic Bridge River Complex to hemi-pelagic siltstones, turbidites, and volcaniclastic sandstones that typify the Cayoosh assemblage. This stop provided a key stratigraphic and tectonic link between accreted oceanic crust and overlying basin-fill successions within the southern Canadian Cordillera.

Figure 13. Outcrop of the Cayoosh assemblage.

Stop 3: Pemberton Valley: Thrust-Bounded Stratigraphy

At this overlook into the Pemberton Valley (**Figure 14**), we had a broad view of a structurally complex landscape underlain by thrust fault systems. These faults separate the Lower Cretaceous Peninsula and Brokenback Hill Formations of the Gambier Group to the southwest from metavolcanic rocks tentatively correlated with the Jurassic Harrison Lake Formation. The Gambier Group here includes a mix of volcaniclastics, and sedimentary units formed in an active arc or back-arc setting. In contrast, the Harrison Lake-equivalent rocks to the northeast reflect earlier volcanic arc activity. This stop was valuable for contextualizing the stratigraphic and structural juxtapositions that define much of the southern Coast Belt geology.

Figure 14. Outcrop of the Pemberton Valley stratigraphy.

Day 7: *Britannia Mine Museum*

Continuing with the route towards Vancouver, we made a stop in the historically important past producer Britannia Mine located approximately 60 km north of Vancouver. The deposit is composed of multiple high grade Cu-Zn volcanic-hosted massive sulphide lenses. The total production of copper from the Britannia Mines from the beginning of operations in 1906 until I924 was more than 200 million pounds. The tour included a shallow underground visit (**Figure 15**) where the guide showed us the different mining methods used by the miners and the evolution of underground exploitation where the Britannia mine was a pioneer in the development of more efficient and safe mining methods. After going back to the surface, we had a quick tour through the mill where an interactive video was displayed showing the different mineral processing methods used back then and the importance of the design of the building to take advantage of the gravity.

Figure 15. *Left:* Underground visit to the Britannia Mine. *Right:* Interactive explanation of the mill mineral processing in the early 1900's.

Day 8: *UBC-MDRU Facilities tour*

After our arrival to Vancouver, we headed to the University of British Columbia where Nikola Denisová and Matt Manor, former MUN-SEG members, gave a presentation about the porphyry project at MDRU (**Figure 16**), this was particularly useful because with the knowledge of our previous mine visits we were able to understand the porphyry belts in British Columbia from a regional perspective. Following this, Nikola showed us around the research facilities at UBC and particularly the laboratories used of MDRU (e.g., SEM, EPMA, LIBS) and opened to us the possibility to use these facilities for our own research projects.

Figure 16. Nikola Denisová and Matt Manor, former MUN-SEG members showing us around the MDRU projects and facilities at UBC.

The visit also included an explanation by Cassady Harraden of the LIBS technology and the uses in the detection of mineralogy and mineral chemistry and the current uses in porphyry exploration and vectoring in BC. The day ended with a tour by Gary Fung, former McGill-SEG president to the diamond exploration research at UBC, he showed us the different diamonds in their collection and a quick overview of kimberlite formation and exploration in Canada and other cratons in the world (**Figure 17**).

Figure 17. *Left*: Cassady Harraden showing us the LIBS technology and related research at UBC. *Right*: Gary Fung explaining the various diamond exploration-related research and exploration methods.

After finalizing a busy day at UBC, we headed to the Vancouver International airport to catch our flights back to St. John's.

Acknowledgments

We would like to thank our academy and industry mentors, Stephen J. Piercey and Lawrence Winter for their helpful advice and for providing useful industry contacts while planning the field trip and for the financial support. We thank Michelle Buchanan, Sean Tombre, and Claire Leighton of New Gold Inc.; John Ryan and Ayesha Ahmed of Teck Resources; Will Whitty of Nicola Mining Inc.; Neal Mankins of Hudbay Minerals and Nikola Denisová, Matt Manor, Cassady Harraden, Warren Wegener and Gary Fung of MDRU and UBC for sharing their resources, time and expertise for this field trip. We also thank the Society of Economic Geologists (Stewart R. Wallace Fund), the Prospectors and Developers Association of Canada (student field trip funding program), and our local industry sponsors: Altius Minerals and Maritime Resources for providing financial resources for the execution of this field trip.