

Yukon Geological Survey's Outreach Program: 2023 highlights

Leyla Weston* and Amanda O'Connor
Yukon Geological Survey

Weston, L. and O'Connor, A., 2024. Yukon Geological Survey's Outreach Program: 2023 highlights. In: Yukon Exploration and Geology Overview 2023, L.H. Weston and Purple Rock Inc. (eds.), Yukon Geological Survey, p. 53-61.

Introduction

The Yukon Geological Survey (YGS) includes a staff of approximately 20 geoscientists that conduct a wide variety of studies, including traditional bedrock and surficial mapping, community hazards mapping (e.g., monitoring landslides and thawing permafrost), mineral assessments, metallogeny and geothermal research. The role of geoscientists is to provide the knowledge required to meet society's demand for natural resources, environmental sustainability, and improved resiliency against geohazards (American Geosciences Institute, 2012).

The mandate of YGS is to provide objective, geoscience-related information to government, Yukon First Nations, and the public. Our research helps inform geoscience-related policy and investment decisions in Yukon, as well as support the land-use planning process. As a public government organization, we must improve geoscience literacy through effective communication so that all citizens of the Yukon understand how Earth's systems (lithosphere, biosphere, hydrosphere, and atmosphere) influence their everyday lives. Educating Yukoners will help them to make informed judgments that affect our territory and encourage public participation in policy making.

Yukon Geological Survey recognizes the importance of having geoscientists on staff who are dedicated to outreach and education. As of September 2023, YGS has two full-time, permanent Outreach Geologist positions. This paper is a summary of YGS' outreach and education activities over the last year.

Earth science education in Yukon schools

Geoscience is essential to tackling climate change, natural hazards, and the green energy transition, and yet enrolment in Earth science programs at Canadian universities has been on a steady decline since 2015 (Council of Chairs of Canadian Earth Science Departments, 2022). The Yukon, along with other parts of northern Canada, is seeing annual mean temperatures increase by almost three times the global mean average (Environment Canada, 2023), which will have tremendous impacts on the territory in terms of geohazards related to permafrost thaw, increased forest fire activity, and flooding. Furthermore, the green energy transition will require more geoscientists than ever. Our current generation of youth, including our Indigenous youth in the Yukon, have demonstrated a

keen interest in taking action against climate change (Carter et al., 2021; Yukon Youth Panel on Climate Change, 2021; Yukon First Nations Climate Action Fellowship, 2023). There is a real need to educate our children and youth on the significant role that Earth science plays in climate change action:

"I've never learned much about mining in the Yukon. It's either been from TV shows who romanticize the industry or media discussing environmental disasters at mine sites. We'd all benefit from a clearer relationship with mining companies, that's how we guide constructive conversation."
– Yukon youth (Yukon Youth Panel on Climate Change 2021)

* leyla.weston@yukon.ca

Yukon schools follow the British Columbia curriculum with some Yukon-specific adaptations. Concepts of Earth science are introduced in grade three; however, the authors have recognized from experience that some concepts of Earth processes can be introduced even earlier (Fig. 1). To support Yukon teachers, YGS designs geoscience education lessons for the classroom that enhance the school curriculum. Lessons are designed to be engaging and predominantly consist of hands-on activities rather than a lecture-style format (Fig. 2). Activities vary depending on what is requested by the teacher and may include any number of Earth science topics such as the rock cycle, rock and mineral identification, geological time, geohazards, glacial landforms, or the uses of mineral resources in our everyday lives (Fig. 3). Every attempt is made to feature rock samples from the local area.

Whitehorse has incredible access to greenspace and provides great opportunities to bring the classroom outdoors for geology field trips to local points of interest. Field trips provide students with first-hand experiences of the local environment, allowing them to observe geological processes in the real world. Most trips focus on sites within the Whitehorse city limits such as the Whitehorse Copper Belt, Miles Canyon, Ibex Valley, Golden Horn, and Chadburn Lake area (Fig. 4). Science programs such as the Wood Street School's French Achievement, Challenge, Environment and Stewardship (FACES) and Experiential Science (ES) programs have participated in field trips farther afield, to places such as the Takhini thaw slump, Slims River in Kluane, and the Carcross dune fields. Through these



Figure 1. Amanda O'Connor describes the layers of the Earth and introduces concepts of the rock cycle to the grades 1 and 2 class of St. Elias Community School in Haines Junction.

field trips, students learn a variety of Earth science concepts, including (but not limited to) mineral and rock identification in the field, basic mapping techniques, the mining history of Whitehorse and the role that mining plays in our territory, permafrost and geohazards, and how to identify various glacial landforms. When weather permits, YGS outreach educators follow up school visits with a field trip to emphasize and illustrate concepts learned in the classroom. Although most geoscience education takes place during the school year, YGS outreach educators are also actively involved in leading guided field trips for youth day camps in the summer (Fig. 5).



Figure 2. Yukon Geological Survey–designed geoscience lessons to enhance the school curriculum: **a)** grade 5 students from Whitehorse Elementary work together on a rock identity activity; **b)** grade 11 students from the Porter Creek Secondary Wilderness Initiatives for Leadership Development (WILD) program learn about the physical properties of minerals.

In 2023, YGS outreach educators, with support from other YGS staff, reached more than 540 students through classroom visits and field trips, including students at community schools in Mayo (J.V. Clark School), Carmacks (Tantalus Community School), and Haines Junction (St. Elias Community School).

Public and community outreach

Public geoscience literacy is also critical in our adult population so that residents can make intelligent and informed decisions that will not only affect the quality of their lives, but also those of their children. Public outreach by YGS is delivered through guided field trips, public talks, and open houses. This year, YGS staff participated in a few events of note, which are discussed below.



Figure 3. Grade 5 students from Golden Horn Elementary learn how rocks and minerals are used in our everyday lives.



Figure 4. Yukon Geological Survey outreach educators bring the classroom outdoors in the form of geology field trips to local points of interest: **a)** grade 3 students from Selkirk Elementary learn about glacial landforms; **b)** grade 5 students from Whitehorse Elementary collect mineralized rock from the Whitehorse Copper Belt; **c)** grade 11 students from Wood Street's Experiential Science (ES) program work through a map and compass activity.



Figure 5. Leyla Weston of YGS leads an afternoon field trip to the Whitehorse Copper Belt for the Ta'an Kwäch'än Council's children's summer camp.

Flood mapping workshop

In early March 2023, a two-day flood mapping workshop was hosted by the Water Resources Branch of the Government of Yukon. The intent of the forum was to bring together representatives from Yukon First Nation governments and the Government of Yukon to discuss the impacts of flooding on Yukon communities. Federal representatives from Climate Change Preparedness in the North and Canada Centre for Mapping and Earth Observation were also invited as observers. On Day 2, YGS was invited to present on geohazards associated with flooding. With so many Yukon First Nation governments together at one time, YGS saw an opportunity to also introduce some of their other program activities and research, including a presentation on how to access data and publications produced by YGS. Participant feedback was very positive and there was a clear desire for similar forums in the future.

"I thought this event was really well put together and connected related work. I would love to see the presenters from this event put together a concise presentation or open house that tours the communities and is open to the public."- First Nation Government participant.

Sunnydale landslide open house

In August 2023, three YGS staff attended an open house in Dawson City to share results from their collaborative research with BGC Engineering on the Sunnydale landslide, situated on the west bank of the Yukon River at Dawson City. Citizens of the community learned about the recent hazards assessment of the Sunnydale slide, which modelled six different failure scenarios including predicted slide runouts and resultant displacement waves in the Yukon River. Derek Cronmiller, YGS permafrost geologist, who is the technical lead for the Sunnydale and Moosehide slides in Dawson City, also discussed the April 2023 installation of near-real-time monitoring stations on the Sunnydale slide. The monitoring equipment communicates the movement of the slide every hour to a base station at the Dawson City Fire Hall, and position data can also be checked by YGS staff through a web portal (Fig. 6). Similar monitoring equipment was also set up on the Moosehide slide in August 2022. The goal of the monitoring equipment is to provide an early warning system that will alert the community if ground movement accelerates, which could be an indicator of a pending slide. The landslide monitoring work is a joint initiative by the Government of Yukon, the Tr'ondëk Hwëch'in First Nation government, and the City of Dawson.

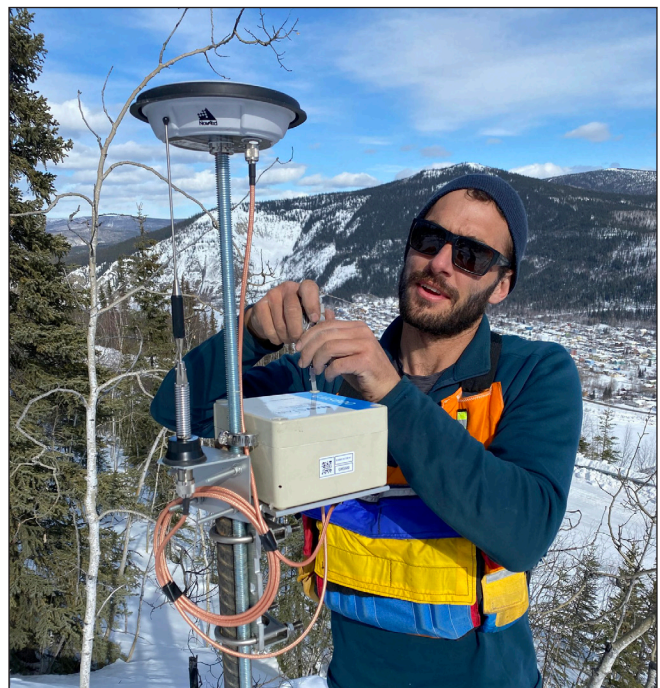


Figure 6. Derek Cronmiller of YGS installs near-real-time monitoring equipment at the Sunnydale slide in Dawson City.

Kluane Park interpretive hike

In June 2023, YGS geologists Rosie Cobbett, Jeff Bond, and Leyla Weston (the first author) led an interpretive hike near Sheep Mountain in Kluane Park. The interest was overwhelming, with more than 40 participants (Fig. 7). Cobbett, who has mapped extensively in southwest Yukon, led the bedrock geology component of the field trip, while Bond talked about the glacial history of the area with a focus on the Slims River piracy and paleoclimate. The event was a collaborative effort by YGS and Kluane National Park and Reserve staff. Park staff recognize that there is interest from the public to learn about the geology of the Kluane region and the goal is to provide a weekend of guided hikes and talks on a regular basis.

International Geodiversity Day

Enhancing public geoscience literacy has been a long-standing initiative for geological surveys across Canada. Recently, the National Geological Surveys Committee (NGSC) developed the Pan-Canadian Geoscience Strategy (PGS), which aims to develop a more coordinated effort between Canada's geological surveys to deliver public geoscience. The PGS' long-term vision is "to provide geoscience information that underpins the responsible development of Canada's geological resources and serves the public good." (National Geological Surveys Committee, 2022). Five interdependent priority areas for action are defined in the strategy: advancing framework geoscience, advancing mineral and energy potential modelling, facilitating access to online data, supporting the training of next-generation geoscientists, and enhancing public literacy (National Geological Surveys Committee, 2022, p. 2). Committees were set up for each of these priority areas; Weston and O'Connor sit on the committee for the 'enhancing public literacy' priority area, along with geoscientists from several territorial and provincial geological surveys. The committee decided to promote UNESCO's International Geodiversity Day, which occurs annually on October 6, to meet some of the goals of the PGS. The committee invited geological surveys across Canada to promote geodiversity in their respective provinces and territories. Participating geological surveys celebrated their jurisdiction's geodiversity by offering local field trips, talks, or other public events. At YGS, outreach educators put together a social media event titled 'Wake up to Yukon geology' that highlighted several features of Yukon's geology. Posts were made to Facebook and Instagram as the clock struck 8 a.m. across each of Canada's six time zones. Topics covered included the discovery of Nun cho ga, critical minerals in



Figure 7. Rosie Cobbett, Jeff Bond and Leyla Weston of YGS led a public field trip in Kluane that attracted more than 40 participants.

Yukon, the Moosehide slide in Dawson, the geothermal potential of Yukon, permafrost, and Mount Logan—the highest peak in Canada.

Dakwākāda Mountain Festival

Finally, in early November 2023, some of the YGS staff were invited to participate in the Dakwākāda Mountain Festival in the community of Haines Junction. The annual festival, now hosted by the Champagne and Aishihik First Nation, returned after a hiatus due to the COVID-19 pandemic. The festival celebrates Dákeyi (the Traditional Territory of the Champagne and Aishihik First Nation) through First Nations culture, learning, science, research, and mountain culture. The one-day festival featured workshops, talks, art, films, live music, dance, and storytelling. Weston (first author) gave a talk on YGS geothermal research in Yukon with a focus on the community of Haines Junction. O'Connor (the second author) and Moya Painter of YGS ran a booth featuring the augmented reality (AR) sandbox along with an outreach activity designed to challenge the public to think about the rocks and minerals that make up items that are used in everyday life (Fig. 8).



Figure 8. Yukon Geological Survey participates in the Dakwākāda Mountain Festival in Haines Junction: **a)** Leyla Weston presents on YGS’ geothermal research in Yukon; **b)** Amanda O’Connor and Moya Painter facilitate geoscience outreach activities at the festival.

Events

Every year, YGS participates in, and/or facilitates several geological events for Yukon students and the public that highlight aspects of Earth science and Yukon geology. Below are descriptions of the main events that bring together hundreds of students and the public each year.

Mining Week

Mining Week is an annual celebration that takes place in early May. The event is hosted by Yukon Women in Mining in partnership with the Yukon Chamber of Mines, and illustrates the importance of the role that mining and geology play in our society. The contribution of YGS, facilitated by Weston, is to organize an evening public field trip to the Whitehorse Copper Belt and student tours to the one-day Discovery Day Camp. Mining Week Discovery Day Camp is a highly anticipated event for teachers and students alike. In 2023, more than 200 students in grades 4–12 descended on Rotary Park in Whitehorse to participate in the event, which takes place partially within wall tents and partially outdoors. Students cycle through a variety of mining and geology-themed activities. The YGS ran rock and mineral identification activities for students, a product matching activity, and a geological mapping exercise (Fig. 9). Students also learned about topographic maps through an activity done in the AR sandbox.

Weekend on the Rocks

Tombstone Territorial Park, known as Ddhäl Ch’èl Cha Nän, which means ‘ragged mountain land’, is situated

on the Traditional Territory of the Tr’ondëk Hwëch’in First Nation. The park is a very popular destination for tourists and Yukoners alike and offers a variety of programming throughout the summer. Every weekend in August, the Tombstone Interpretive Centre highlights a different aspect of the park’s natural history. The YGS hosts ‘Weekend on the Rocks’ at the end of August each year. In 2023, YGS geologists led three guided walks and two evening talks highlighting the geology of the Tombstone region. Guided hikes included Goldensides, Charlie’s Canyon, and the Grizzly Lake trail, which ends at a viewpoint overlooking the valley leading to the spectacular peaks of Mount Monolith (Fig. 10). All hikes involved multiple stops to discuss the geology of the area and point out interesting rocks or features.



Figure 9. Grade 8 students from the Wood Street French Achievement, Challenge, Environment and Stewardship (FACES) program build a simple geological map at Discovery Day Camp during Mining Week.

Participants learned about the geological history of the park firsthand while observing some of the clues in the rocks and landscape that geologists have used to piece together this history. Rosie Cobbett and Jeff Bond, geologists from YGS, presented the evening talks. Cobbett gave an overview of the geological history of the park, and Bond spoke about the surficial geology and paleogeography of Beringia. Both talks were held in the Tombstone Park Interpretive Centre and were very well attended (Fig. 11).

Yukon Geoscience Forum Family Day

Every year in November, the Yukon Chamber of Mines hosts Yukon's Geoscience Forum and Trade Show in downtown Whitehorse. The four-day conference covers all aspects of the mining industry in Yukon and brings together industry experts, geoscientists from government and academia, representatives from First Nations and Yukon governments, investors, and members of the supply and service sector. Public outreach occurs on Family Day, a one-day event where residents of Whitehorse learn about the role the mining industry has in the Yukon while exploring a variety of interactive booths. Education activities in 2023 included a flight simulator; a tour of a mine site using a virtual reality headset; digging for stones, gems and metals; learning about biostratigraphy; identifying features in a placer mine through a diorama; and spotting hazards using various images of work in the office and in the field. The authors, along with Bailey Staffen, Moya Painter and Orlina Ménard of YGS, brought the AR sandbox, rock and mineral identification activities, and the ever-popular product-matching activity (Fig. 12). This year, Family Day attracted more than 300 people of all ages.

Training and inreach

Staff at YGS are often called upon throughout the year for their expertise on geological topics and sites in the Yukon. This can be in the form of outreach for private, non-profit organizations (e.g., Yukon Conservation Society) or inreach for other Government of Yukon branches (e.g., Water Resources Branch, Department of Highways and Public Works, Historic Sites, and the Yukon Beringia Interpretive Centre). In the past, Weston has been involved in providing non-technical text for Historic Sites on the geology of sites for their interpretive panels including the Tintina Trench, Mt. Haldane near Mayo, and the geology of Montana Mountain. Geoscience outreach and education have been a priority for YGS for more than a decade, and other



Figure 10. Field trips led by YGS during Weekend on the Rocks in Tombstone Territorial Park: **a)** Rosie Cobbett searches for radiolarians in chert with a participant on a guided hike through Charlie's Canyon; **b)** Leyla Weston discusses the local geology on the Grizzly Lake trail.



Figure 11. Jeff Bond presents on the glacial history of Tombstone Park with highlights on Beringia during Weekend on the Rocks.



Figure 12. At the Yukon Geoscience Forum Family Day: **a)** Leyla Weston gives a lesson on topography in the augmented reality sandbox; **b)** Bailey Staffen helps participants match rocks and minerals to everyday products; **c)** Amanda O'Connor teaches a youngster about the physical properties of minerals.

departments of the Government of Yukon are starting to look to YGS for how they can further develop their own outreach efforts or expand on their programming. This year, the Youth Programs Coordinator from Government of Yukon's Department of Environment asked Weston to provide training for the camp leaders of their Yukon Youth Conservation Corps (Y2C2), a summer employment and training program for Yukon students aged 16 and up. Students work in small groups on environment and conservation-related projects around the territory. Weston spent one day with senior Y2C2 camp leaders looking at the roadside geology along the Alaska Highway from Whitehorse to Marsh Lake. Later, Weston and Moya Painter followed up with a half-day discussion of bedrock geology and glacial history in the Annie Lake area south of Whitehorse (Fig. 13).

First Nations engagement

Yukon Geological Survey engages with Yukon First Nations (FN) with respect to our program activities. To build trusting and meaningful relationships with Yukon's FN governments, YGS endeavors to increase communication and seek input from FNs early in the planning stages of projects. Routine engagement includes spring and fall update letters to all affected FNs with respect to our program activities as well as meetings with the Lands and Resources staff of the FN governments. In 2023, YGS engaged with 12 Yukon FNs on bedrock mapping; targeted permafrost studies; community mapping; landslide studies; metallogeny; and a regional magnetotelluric geophysical survey (for geothermal research), which was in collaboration with the Geological Survey of Canada.



Figure 13. Moya Painter of YGS discusses the glacial history of the Annie Lake area with camp leaders of the Yukon Youth Conservation Corps youth program.

The Yukon Geological Survey also continues to actively engage and collaborate with several First Nations regarding ongoing geothermal research in southern Yukon. There is great interest from Yukon FNs to become self-reliant and to move toward cleaner energy solutions, particularly in communities that rely on diesel fuel for heat and energy (e.g., Watson Lake, Burwash Landing, Destruction Bay, Beaver Creek, and Old Crow). In 2020, YGS acquired \$2M of funding over three years from Natural Resources Canada's Emerging Renewable Power Program to explore for geothermal resources associated with crustal-scale fault systems. With funding for this program nearing its end, YGS held an information session in October 2023 to share some results from the last several years of research. The one-day information session was by invitation only to Yukon FN governments and community administrators, and included several presentations and a panel discussion including perspectives of FN governments, industry professionals, and university researchers. Representatives from six FNs and five municipal governments attended, along with representatives from other organizations such as the Council of Yukon First Nations, the Government of Yukon's Energy Branch, and the Yukon Development Corporation.

Summary

Understanding geoscience is becoming increasingly vital for all citizens. For Yukoners, having a better understanding of Earth science will be necessary to meet the four goals outlined in the Government of Yukon's Our Clean Future strategy: reduce Yukon's greenhouse gas emissions by 45% by 2030; ensure Yukoners have access to reliable, affordable, and renewable energy; adapt to the impacts of climate change; and build a green economy (Government of Yukon, 2021). Geoscience knowledge is also critical to making informed decisions concerning land-use planning and development. The YGS views geoscience outreach and education as essential to provide all Yukoners and Yukon First Nations with accurate geological information that will help our communities move toward greater sustainability.

References

- American Geosciences Institute, 2012. Critical Needs for the Twenty-first Century: The Role of the Geosciences. American Geosciences Institute, 24 p.
- Carter, S.C., Griffith, E.M., Jorgensen, T.A., Coifman, K.G. and Griffith, W.A., 2021. Highlighting altruism in geoscience careers aligns with diverse US student ideals better than emphasizing working outdoors. *Communications Earth & Environment*, vol. 2, article 213, <https://doi.org/10.1038/s43247-021-00287-4>
- Council of Chairs of Canadian Earth Science Departments, 2022. Survey of Canadian Earth Science Departments: Program registrations 1974 to 2022. <https://ccesd.acadiiau.ca/rep2022.html>, [accessed November 15, 2023].
- Environment Canada, 2023. Annual temperature change. <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/temperature-change.html>, [accessed November 15, 2023].
- Government of Yukon, 2021. Our Clean Future: A Yukon strategy for climate change, energy and a green economy. Government of Yukon, 72 p. <https://yukon.ca/en/our-clean-future-yukon-strategy-climate-change-energy-and-green-economy>
- National Geological Surveys Committee of Canada, 2022. Pan-Canadian Geoscience Strategy: Enhancing geoscience data, knowledge and access for a stronger future. Natural Resources Canada, General Information Product 131e, 24 p. <https://doi.org/10.4095/329347>
- Yukon First Nations Climate Action Fellowship, 2023. <https://reconnection.vision/>, [accessed November 25, 2023].
- Yukon Youth Panel on Climate Change, 2021. Our Recommendations, Our Future: 27 Programs and Policies to Embolden the Yukon's Climate Action. YPCC, 9 p.