**M.Sc., Ph.D., and Postdoctoral Researcher Positions in Slope Geohazards**

In July 2027, Queen's University will establish an Eddie Goldenberg Research Chairs of Canada Program focused on *Slope Geohazard Management for Infrastructure and Mining in a Changing Climate* under the direction of incoming Chairholder Dr. Gabriel Walton. To support this ambitious new research program, Dr. Walton is recruiting up to 10 graduate students (Master's and Ph.D.) and up to 3 postdoctoral fellows to contribute to the program's research mission starting in the Fall 2027 (postdoctoral fellows can start as early as April 2027) semester. Members of equity-deserving groups are encouraged to apply.

Official job postings can be found here: https://www.queensu.ca/geol/about/employment

Preliminary expressions of interest should be submitted to g.walton@queensu.ca with the subject line "Eddie Goldenberg Program Application" by no later than **November 15, 2026** (please see official job postings for details on required materials).

*Example Projects (some Masters-level projects may have the opportunity to expand to Ph.D.-level scope)*

**Masters Level – Developing a Framework for Slope Monitoring Using Photographic and Point Cloud Techniques:** Photographic and point cloud (e.g. lidar, photogrammetry) monitoring techniques are increasingly common for evaluation of slope hazards, but unlike more traditional monitoring technologies, guidelines for their use are not well established or documented. This project will contribute to the design of a nationwide monitoring network and combine lessons learned from this process with critical analysis of the literature and interviews with practitioners to compile best practices for monitoring program design.

**Masters Level – Improving Automated Point Cloud Registration:** Existing approaches for point cloud registration rely on an initial coarse registration step that is typically highly sensitive to one or more input parameters, depending on the algorithm used. Input parameters that result in an appropriate registration may vary between sites or even between distinct point clouds (e.g. individual lidar scans) collected at the same site. This project will develop improved metrics for registration performance and use these to implement a concept for an iterative coarse registration approach that will automatically select optimal algorithm input parameters.

**Masters Level – Improving Approaches for Rockfall Detection from Photographic Monitoring:** Photographic timelapse monitoring of rock slopes can provide a cheap and simple alternative to other approaches such as fixed photogrammetry or repeat laser scanning. While techniques for automated detection of rockfalls by comparison of sequential photos exist, their performance can be inconsistent and require substantial manual intervention to limit false positives, particularly when the goal of monitoring is to detect relatively small rockfalls. This project will focus on evaluating alternative approaches for automating rockfall detection in the context of photographic monitoring and will ultimately develop improvements to more effectively differentiate small rockfalls from noise.

**Masters Level – Evaluating the Influence of Rockfall Fragmentation Characteristics on Runout and Implications for Slope Design:** Rockfall blocks often break apart as they travel downslope, which can significantly influence their movement and final stopping locations. Despite this, most rockfall runout analyses do not account for fragmentation effects. Recent advances have enabled fragmentation processes to be incorporated into commercial rockfall modeling software, but the implications for hazard assessment and mitigation design remain poorly understood. This project will use case studies and numerical modeling to investigate how rockfall fragmentation affects predicted runout behaviour and how uncertainty in fragmentation parameters influences estimates of rockfall hazard.

**Masters Level – Evaluation of Rockfall Trends for a Large Natural Slope at a Hydropower Site:** A large natural rock slope sits above the abutment of a dike at a hydropower site in Quebec. This represents a risk to the infrastructure below, and while previous analyses have been conducted to assess risk, quantitative information regarding the underlying rockfall hazard is limited. This project will use a combination of field mapping and analysis of lidar monitoring data (both historical and newly collected during the project) to quantitatively assess the frequency-magnitude distribution of rockfalls at the site and their implications in a risk framework.

**Masters Level – Slope Instability Mechanisms at Pink Mountain, BC:** Pink Mountain has many actively deforming slopes and is located in a region where permafrost degradation and climate-driven changes may influence long-term slope stability. Although ongoing deformation has been identified, the geological and thermo-hydro-mechanical processes controlling instability remain poorly understood. This project will combine field mapping, remote sensing data analysis, and slope stability analyses to investigate the mechanisms governing slope deformation and assess potential future changes in slope stability.

**Masters Level (co-supervisor – Dr. Renato Maciotta, University of Alberta) – Evaluating the Influence of Rockmass Quality and Heterogeneity-Influenced Damage Zones on Rockfall Hazard:** It is generally established that rockmass quality variations both within and between slopes are directly tied to corresponding variations in rockfall activity and characteristics. There are limited number of existing studies, however, that evaluate these relationships in detail. This project will use multiple years of existing repeat lidar monitoring data at two slopes in the Canadian Rockies to study how rockmass characteristics and localized heterogeneity-influenced damage zones affect rockfall hazard.

**Masters Level – Preliminary Canada-Wide Slope Hazard Characterization:** Recent efforts have led to the development of a Canada-wide landslide database (Brideau et al., 2026). While this represents a major step forward in the characterization of hazard, most the inventoried hazards do not have recorded timing or size information. As a complement to this existing database, this project will survey the literature and use historical imagery and remote sensing data to quantify slope hazards in a frequency-magnitude framework and ultimately to develop a preliminary and approximate extrapolation of hazard at the nation-wide level.

**Ph.D. Level – Development of Approaches for Geotechnical Applications of Hyperspectral Data in Open-Pit Mining:** Hyperspectral data are now commonly collected at open-pit mining sites to support geological characterization activities, but limited research has been conducted to fully develop the potential of these data to support geotechnical characterization and design. Through partnerships with operating mines and engineering consultants, this project will advance knowledge of how hyperspectral data map to geotechnical characteristics and will develop practical guidance for their integration into geotechnical workflows. Early efforts will involve site-level core-scale data analysis, but opportunities exist to expand into research evaluating multi-site generalization of findings, as well as potential evaluation of field-scale hyperspectral data and comparative analysis across scales.

**Ph.D. Level – Development of a Framework to Evaluate the Contribution of Permafrost Thaw to Progressive Instability of Rock Slopes (co-supervisor – Dr. Stephan Gruber, Carleton University):** Many permafrost landslides in fractured rock exhibit complex movement mechanisms. In such cases, it is difficult to disentangle the contributions of various factors (e.g. permafrost thaw, variations in precipitation and groundwater, time-dependent progressive damage) to changes in slide movement and stability over time. This project will involve the development and testing of a framework for evaluating the role of permafrost degradation in controlling slide behaviour through the characterization of rockmass characteristics and permafrost conditions at multiple sites in northern Canada. Additionally, numerical simulation of a limited number of cases will be used to evaluate statistical trends derived from analysis of field data and to establish a range of potential future scenarios for landslide behaviour under forecasted permafrost conditions.

**Ph.D. Level – Centrifuge Scale-Modelling of Fractured Rock Slope Instability Under Permafrost Degradation (co-supervisor – Dr. Greg Siemens, RMC):** Making use of the state-of-the-art CASTLE facility at Queen's University, this project will develop scale models intended to simulate open pit mine slopes experiencing permafrost degradation and test them in a geotechnical centrifuge. The project will involve experimental design (including model material and monitoring techniques) and analysis of results from increasingly complex physical models to evaluate interactions between thawing ice, pre-existing fractures, intact rock damage, and external hydrological forcing in controlling progressive evolution of slope instability.

**Ph.D. Level – Quantitative Assessment of Debris Flow Hazard in British Columbia (co-supervisor – Dr. Scott McDougall, UBC):** Debris flows are a common hazard in British Columbia. Many prior studies have been conducted to understand these hazards in specific local areas, but the overall degree of hazard at the province-wide scale is not well-constrained. To facilitate large-scale characterization of debris flow hazard, this project will involve the development of a semi-automated approach for debris flow identification from historical satellite remote sensing data. Using this approach, debris flow hazard will be quantified at the provincial level and studied to better understand how temporal variations in hazard relate to broad-scale weather patterns.

**Postdoctoral Level – Advancing Thermo-Hydro-Mechanical Modeling Approaches for Fractured Permafrost Rockmasses (co-supervisor – Dr. Mehdi Pouragha, Carleton University):** Existing thermo-hydro-mechanical (THM) models typically capture only a subset of the complex feedbacks among heat transport, groundwater flow, fracture evolution, and rock deformation that govern the long-term behaviour of rockmasses experiencing permafrost degradation. The postdoctoral researcher assigned to this project will lead the development and application of advanced numerical models to investigate the coupled processes governing permafrost degradation, fracture evolution, groundwater flow, and slope deformation, while collaborating closely with graduate students and project partners to integrate field observations with process-based simulations. This position offers an opportunity to make fundamental advances in coupled-process mechanics while contributing to improved understanding and management of climate-driven geohazards in cold regions.

**Postdoctoral Level – Development of a Canada-Wide Photographic Slope Monitoring Network:** The Research Chair will establish an ambitious nationwide network of monitoring sites using photographic, fixed photogrammetric, and periodic lidar monitoring. The postdoctoral researcher assigned to this project will work with the Chair's team and external partners to select sites for monitoring, design site-specific monitoring plans, set up initial monitoring sites, and perform research related to the processing and use of the derived data. This position will serve as a foundation for long-term collaborative research based on the data collected by the monitoring network.

**Postdoctoral Level – Development of Approaches for Incipient Rockfall Detection Using Remote Sensing:** While overall geohazard risk can be assessed at the individual site/asset scale, corridor scale, or network scale, individual hazard event occurrences tend to be somewhat "random" in nature. What this means is that responses to individual hazard events occur on an emergency or urgent need basis, with no ability to proactively identify and prioritize mitigation measures based on real-time data. The postdoctoral researcher assigned to this project will develop approaches to use remote sensing data (e.g. point clouds) to detect regions of incipient slope instability and forecast rockfall occurrence.

**Postdoctoral Level – Evaluation of Electromagnetic Methods for Permafrost Mapping and Assessment:** Future changes in permafrost in northern Canada will have substantial implications for geotechnical stability of infrastructure, yet characterization of permafrost at scale remains challenging. Drone-based geophysics represents a novel method to track changes in permafrost over time across large areas. Through a partnership with Pioneer Exploration (Ottawa, Canada), the postdoctoral researcher assigned to this project will evaluate the potential of a new time-domain electromagnetic system for permafrost mapping through multi-season tracking of changes in electrical conductivity within the subsurface.