Session 1:

Establishing baseline hydrological conditions and sediment metal concentrations for the Peace River Floodplain in the Peace-Athabasca Delta, using paleolimnology.

Jelle Faber, Wilfrid Laurier University

The Peace-Athabasca Delta (PAD) is a large boreal freshwater delta containing hundreds of shallow lakes that provide important wildlife habitat. The Delta is internationally recognized for its ecological, historical, and cultural significance (UNESCO World Heritage Site, Ramsar Wetland of International Importance). Concerns over lake water quantity and water quality stem from multiple potential stressors on the PAD, including past and current construction of hydroelectric dams on the Peace River (recent approval and construction of Site C), upstream oil sands development, and climate change. Here, we use paleolimnological approaches to further enhance knowledge of baseline hydrological conditions of the Peace River, in advance of Site C Dam operation, and to characterize the natural supply of metals to the PAD via the Peace River for broader assessments of the effects of oil sands development. Our goal is to put current environmental and hydrologic conditions of the PAD in the context of the past. During summer 2016, ~35-60-cm long sediment cores were obtained using a hammer-driven gravity corer from four floodplain lakes along the Peace River. Sediment cores were described and sectioned at 1-cm intervals. Sediment sub-samples are currently being analyzed for radiometric (137Cs, 210Pb), physical (loss-on-ignition), and geochemical (organic carbon and nitrogen elemental and isotope composition, cellulose oxygen isotope composition, metal concentrations) parameters and biota (diatoms, pigments) to reconstruct past hydrological conditions and metal deposition. Preliminary loss on ignition results show strong potential for reconstructing flood frequency. Findings will be of interest to multiple stakeholders and will inform stewardship of the delta.

Paleolimnological reconstruction of the trophic history of two lakes from the Fermont mining region (Subarctic Quebec, Canada)

Olivier Jacques, Université Laval

The emergence of important cyanobacterial blooms at the surface of lakes Sans Nom and Carheil over the last few years indicates a eutrophication process in both systems. The residents of the town of Fermont (Subarctic Quebec, Canada) are concerned by their declining water quality and have plans for their recovery. However, only little information is available on the past characteristics of lakes Sans Nom and Carheil, which limits our understanding of the problem. This research project aimed at defining the natural state and variability of the lakes and to identify the causes and the extent of their deterioration using a paleolimnological approach. The results indicate that both lakes have been relatively stable for thousands of years before being progressively enriched following the onset of the industrial era (~ 1850 years AD)
Discerning the effects of major energy projects, climate change and distributary flow on lakes of the Athabasca Delta using paleolimnology

Mitchell Kay, University of Waterloo

The Peace-Athabasca Delta (PAD) in northern Alberta is the world’s largest boreal freshwater delta. Concern has been growing over potential effects of major energy projects and climate change on lakes in the delta. In the southern Athabasca sector, prior paleolimnological analyses at three lakes identified that hydrological conditions are strongly influenced by recent changes in distributary flow and other research determined that river sediment metal concentrations are within the range of natural variability. Yet, uncertainty remains regarding the extrapolation of these results over space and time, given the hydrologically dynamic and complex nature of the Athabasca Delta. Consequently, sediment cores were collected in summer of 2015 and 2016 from 10 lakes spanning the Athabasca Delta using a hammer gravity corer, and sectioned into 1-cm intervals. Sub-samples from each interval are being analyzed for chronological, physical and geochemical variables, diatom algae, and concentrations of metals to reconstruct past hydroecological conditions and metal deposition for the past >100 years. Results confirm that recent geomorphic changes, which have altered the flow-path of the Athabasca River and its distributaries within the delta, have had a profound influence on sediment composition. The timing of the changes identifies the natural river avulsion in 1982, known as the Embarras Breakthrough, as the main cause of the changes, not the 1968 construction of the WAC Bennett Dam as has been widely believed. Ongoing analyses will continue to refine paleohydrological reconstructions and establish baseline sediment metals concentrations required to assess for evidence of pollution from upstream oil sands development.

Developing a pre-industrial baseline to evaluate pollution of the Athabasca River in the Alberta Oil Sands Region: a paleolimnological approach

Wynona Klemt, University of Waterloo

Alberta oil sands began operations in 1967, but onset of environmental monitoring for pollution of the Athabasca River and adjacent floodplain lakes began 30 years later. Consequently, no pre-industrial baseline exists upon which current river sediment quality can be compared. This situation is further complicated, because the Athabasca River flows through the naturally bitumen-rich McMurray Formation, where riverbank erosion and groundwater flow provide natural inputs of contaminants to the river. This undermines an ability to determine the relative importance of contaminants supplied by natural versus industrial processes to downstream environments. With the rapid, continual growth of industrial activity, the lack of pre-development
environmental monitoring data is hindering the ability to objectively assess the extent to which the oil sands pollute the Athabasca River. My project will address this critical knowledge gap by analyzing sediment cores from flood-prone lakes located upstream and downstream of oil sands operations to: (a) determine the pre-industrial baselines of metals concentrations and the natural range of variability in sediments carried by the Athabasca River, and (b) assess for evidence of pollution in recent decades. These cores will be dated using gamma ray spectrometry and concentrations of priority metals of concern in the oil sands region (including Be, Cd, Cr, Cu, Pb, Ni, V, and Zn) will be measured and normalized to account for grain-size effects. Preliminary results from sequential loss-on-ignition analyses suggest that these lakes have flooded in the past and, therefore, will provide valuable information about temporal changes in contaminants transported by the Athabasca River.

**Salinity change in a saline boreal wetland in the Athabasca Oil Sands Region, Canada: a diatom-based paleolimnological study**

Olena Volik¹, Richard Petrone¹, Roland Hall¹, Merrin Macrae¹, Corey Wells¹, Jonathan Price¹

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Naturally saline wetlands represent potential natural analogs for reclaimed wetlands in the Athabasca Oil Sands Region (AOSR). We investigated salinity changes at three ponds situated within a saline wetland near Fort McMurray (Alberta). Past changes in salinity were reconstructed using weighted-averaging transfer functions based on diatoms and an environmental dataset from 32 saline boreal ponds. Results reveal complex “precipitation – surface water – groundwater” interactions associated with differences in the hydrologic functioning of the studied ponds, and their connectivity with shallow groundwater aquifers and adjacent wetlands. Relationships between cumulative departure from mean precipitation (CDLM) and DI-salinity suggest that precipitation may control salinity both directly and indirectly. In ponds recharged predominantly by meteoric water, precipitation may govern salinity directly by dilution of salt content in water, so that rises in precipitation result in a salinity decline. In ponds situated within a saline groundwater discharge zone, salinity may be influenced by precipitation indirectly through recharge of the saline aquifer, so increases in precipitation lead to rises in salinity. Our study suggests that complex salinity response to precipitation change, coupled with notable range of salinity fluctuation within natural saline fens should be considered while designing saline constructed wetlands and predicting their potential resilience under climate change.

**Session 2:**

**Sedimentary Evidence from Namu Lake, British Columbia of Changing Moisture Regimes During a Period of Fluctuation in the Staple Pink Salmon Fishery**

Alyson Brown, McMaster University

Pacific salmon has provided nourishment for residents of British Columbia for the past seven thousand years. The abundance, preservation qualities, and nutritive value of this fish made it a staple food source for the prehistoric settlement of Namu, B.C. Namu began as a settlement over 11,000 years BP with a microlithic, flaked stone industry (Carlson 1996), but by ca 7000 years BP there is good evidence that Namu was a permanent village largely reliant on Pacific salmon (Cannon and Yang 2006). The most prevalent species of salmon consumed at Namu
was pink, due to its ability to store over the winter months without spoiling. However, the staple pink fishery at Namu began to fluctuate ~ 3800 cal year BP. This study presents a detailed sedimentary analysis of cores collected from Namu Lake, British Columbia in order to provide evidence for paleoenvironmental conditions that may have contributed to the decline of the pink population ~ 3800 cal year BP. Two short sediment cores (57 and 116 cm) were collected from different locations within Namu Lake at depths 28 and 25m respectively. High-resolution (0.5 cm) particle size analysis was performed on each of the sediment cores. Overall, particle size and trace elemental/Al ratios decline in the period from ~ 3200 cal year towards the present. AMS radiocarbon analysis reveals that these falls occur during the period of decline for the staple pink fishery as reported in archaeological literature.

The impacts of global change on biota and stratification patterns in high elevation Andean lakes

Andrew Labaj, Queen's University

Alpine regions are predicted to show amongst the largest increases in temperature worldwide with climate change. Not surprisingly, the impacts of anthropogenic climate change have been well-documented (e.g., melting ice caps) in the equatorial Andes Mountains. The Andes contain numerous lakes which often serve as critical water reservoirs for millions of people; however the impact of climate change on these sensitive systems is still poorly understood. Here, we discuss the results of a multi-proxy paleolimnological and neolimnological analyses of several lakes from El Cajas National Park, Ecuador, an area that has recorded a warming trend in temperatures over the past ~40 years. In three of the lakes examined for diatoms, the small, planktonic species Discostella stelligera increased in abundance within the past ~50 years, suggestive of increasing stratification. Confirming this, water temperature profiles taken over 2 years from 4 lakes in the park—formerly thought to be cold polymictic systems—suggest that they now thermally stratify by at least 2°C for between ~45–75% of the year. The increased thermal stratification has already impacted lake biota, with one of the lakes recording a marked decline in primary production concomitant with the increase in D. stelligera. Furthermore, three of the lakes examined for Cladocera show marked shifts within the past ~50 years, with the larger pelagic grazer Daphnia replacing the smaller grazer Bosmina. This shift is not directly linked to predation or food supply, but likely a complex interaction of direct and indirect physiological and temperature-mediated factors. Overall, our work highlights the sensitivity of this region to climate change.

XRF chlorine trace elements as a new paleosalinity proxy

Chelsi McNeill-Jewer, McMaster University

There is a general consensus in the scientific community that during the period from 750 to 1100 AD, a series of regional multidecadal droughts interfered with the continuation of the Classic Maya civilization. Though numerous papers have identified precipitation anomalies thought to be responsible for the infamous collapse, none yet have commented on how this directly impacted the drinkability of the water reservoirs that many were reliant on. To address this, high-resolution chlorine trace element counts from two lake sediment cores in Quintana Roo, Mexico have been applied as salinity proxies for the first time using an X-Ray Fluorescence core scanner. The shallow cores have successfully recorded major changes in the amplitude and frequency of salinity over time, with a substantial increase in variation over the period of 750 to 1100 AD. This paper further presents a working paleosalinity equation to
be employed in multidisciplinary studies of climate, surface and groundwater interaction. Our records are in broad agreement with numerous independent records of drought in the region, implying that the increased regional aridity and reduction in precipitation had a significant impact on the salinity of surface and groundwater available to the Maya during the Terminal Classic period.

**Top-bottom analysis of 54 Lakes in Algonquin Provincial Park**

Janae Rampone, Queen's University

Algonquin Provincial Park covers 7,630 km² of south-central Ontario, Canada and includes nearly 1,3000 lakes (>5ha) and is a source for watersheds beginning on the highlands that contribute to the larger Laurentian Great Lakes system. Furthermore, it is only two parks in Ontario, Canada that allows private cottages with current leases set to expire on December 31, 2017. As cottage leases near expiration, it is important to assess if environmental impacts have resulted from cottage and shoreline development in the park lakes. Although Algonquin Provincial Park is one of the oldest parks in Ontario, many lakes in this park have not yet been studied in detail with respect to water quality.

In this study, 22 lakes with established cottages and campground lakes (i.e. impact lakes) and 32 remote, minimally impacted lakes within the park (i.e. reference lakes) will provide context for the effect (if any) of shoreline residential development on lake water quality. The Lakeshore Capacity Model (LCM) is a predictive model that links hydrology, lake morphometry and anthropogenic (septic systems and land disturbances) [TP] sources into a [TP] budget for a lake. The LCM has been applied to all 54 lakes in Algonquin Park (both reference and cottage lakes) and has revealed that the lakes have not yet reached capacity. Based on the water quality and hypothetical scenarios, the model will help contribute to making informed decisions on the extent of any future development.

**Using paleolimnology to assess the effects of road salt application on zooplankton assemblages in lakes within the Muskoka River Watershed, Ontario**

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To promote safe road conditions, road salt is commonly used as a de-icing agent for winter road maintenance. Of the several compounds that can be used for this purpose, sodium chloride (NaCl) is the most commonly used in Canada. In North America, the use of road salt as a de-icing agent began in 1940 and was in widespread use by the 1950’s. While it is undeniable that road salt reduces road accidents it may also have adverse effects on surface water. Because of their conservative nature and relatively high solubility, almost all chloride ions from road salts eventually find their way into waterways downstream. To assess whether biological changes have occurred in lakes, coincident with historical road salt applications, high-resolution cladoceran records from 210Pb-dated sediment cores were examined from five lakes in Muskoka, Ontario. Jevins Lake, located in the Muskoka River Watershed and within sight of Highway 11, has the highest recorded chloride concentration of lakes in the region (84 mg/L). Biological changes in Jevins Lake, including a notable shift in PCA Axis 1 scores in the late
1950s, suggest that road salt application may have been a trigger for recent changes. Specifically, an abrupt increase in the relative abundance of *Alona cicumfimbriata* occurred near the onset of road salt applications in the region. This taxon is known to be relatively saline tolerant. Tooke Lake, a nearby lake with chloride concentrations of 46 mg/L also showed changes in the cladoceran community that coincide with road salt use. Next steps include analyzing diatom assemblages, as salinity is known to be an important variable shaping diatom assemblages in lakes.

**Session 3:**
**Seasonality matters: a quantitative winter climate reconstruction using clastic varves from the Canadian High Arctic**
Benjamin Amann, Queen's University

Winter climate reconstructions have received relatively little attention as compared to the efforts to reconstruct past annual changes in the Arctic. As a result, seasonality is hardly considered in climate models especially for winter; the most sensitive season to Arctic climate change. To target this specific season, recent studies have emerged using sediments from Arctic lakes characterised by a nival (snowmelt) catchment. Sediment transport and deposition in these lakes are primarily governed by the length and intensity of the snowmelt runoff, and indirectly by the preceding winter temperature and snowfall conditions. Nevertheless, very few well-calibrated quantitative records exist for the Arctic, which clearly limits the possibility to resolve large-scale patterns of winter climate change prior the instrumental period. Using the varve record from Chevalier Bay (Melville Island, NWT, Canada), we produce a well-calibrated quantitative record of winter temperature and snowfall conditions over the past 400 years. Chevalier Bay has a catchment with a remarkably large area, which leads to varves that are much thicker than what is commonly reported by studies on Arctic lakes. This enables us to isolate the different hydrology-induced sedimentation processes (snowmelt vs. rainfall). This was key in the development of a reliable and precise varve chronology and for the production of a quantitative climate reconstruction. The thickness of the nival units was used to predict extended winter (November through March) temperature ($r = 0.71$, $p<0.01$) and snowfall ($r = 0.65$, $p<0.01$) for the western Canadian Arctic Archipelago back to AD 1670.

**A unified stable Pb sediment chronology for Halifax, Nova Scotia, Canada**
Dewey Dunnington, Dalhousie University

Establishing chronologies for lake sediment cores is essential to determine causal relationships that form the basis of many paleolimnological investigations. $^{210}\text{Pb}$ dating is an essential tool to establish recent (<150 years) lake sediment chronologies, however there are cases in which $^{210}\text{Pb}$ chronologies are difficult to obtain due to low concentrations of $^{210}\text{Pb}$, difficult to interpret due to complicated $^{210}\text{Pb}$ accumulation history, or not feasible to measure due to time, cost, or availability constraints. Stable Pb is present in measurable concentrations in many lake sediments, is easily and cost-effectively measured, and often follows a regional pattern of increase following aerial deposition of particulates from industrial development. We measured stable Pb concentrations in seven $^{210}\text{Pb}$-dated sediment cores near Halifax, Nova Scotia using X-Ray Fluorescence Spectroscopy. Pb concentrations ranged from non-detect (~2 ppm) to 155 ppm, with a substantial increase observed between 1900 and 1930. Peak lead concentration dates were variable, but generally occurred between 1970 and 1990. The timing of the initial increase was within the range of $^{210}\text{Pb}$ age-depth model error for all lakes, suggesting a common aerial source for lead in the Halifax region. Using stable Pb
concentrations, $^{210}\text{Pb}$ age-depth model error, and rescaling methods, a unified stable Pb sediment chronology was constructed for the Halifax region. This chronology could be applied to create age-depth models for lake sediment cores for which no $^{210}\text{Pb}$ data are available.

**Examining 3,000 years of contaminant exposure to bats: Applying limnological methods to bat guano deposits to reconstruct historical environmental conditions**

Lauren Gallant, University of Ottawa

Bats are excellent ecological indicators owing to their long life spans, global distribution, and predictable responses to environmental stressors as seen in the bioaccumulation of pollutants from dietary intake. Bat guano deposits can be used as environmental archives as metals, stable isotopes, sterols, and stanols are well preserved within the cave environment allowing for the reconstruction of dietary changes and contaminant exposure, respectively. In this study, we apply common lake sediment core methodologies to a bat guano deposit for the purpose of reconstructing historical contaminant and dietary trends. We radiometrically dated the bat guano deposit using three common radioisotopes: $^{210}\text{Pb}$, $^{137}\text{Cs}$, and $^{14}\text{C}$. Notably, the fluctuation in $^{137}\text{Cs}$ activity within the bat guano deposit is evidence of peak nuclear weapons testing. We also present the long-term increase in metals and decrease in $^{206}\text{Pb}/^{207}\text{Pb}$ within this bat guano deposit associated with contaminant exposure in relation to the timing of different anthropogenic activities, such as the Industrial Revolution and the introduction of leaded gasoline, respectively. We also present a triple isotopic approach to determining long-term dietary trends in bat guano. Preliminary results suggest that this 3,000-year-old bat guano core is tracking a change in stable isotopes associated with the agricultural history of Jamaica. The dietary history of the bats was further examined using sterols and stanols; recent peaks in cholesterol and stigmastanol could be evidence of changes in feeding habits (or bat colony composition) over the past 3,000 years.

**Spatial Statistics and Diatom Community Organization: An Argument against Dispersal**

Cale Gushulak, Queen's University

It has been highly debated as to whether microbial metacommunities are organized through selection by the environment or spatial dispersal. The covariability of environmental and spatial variables in lake systems makes the examination of this problem a challenge. Forty-one surface sediment samples collected in a spatial matrix from Gall Lake, Northwest Ontario, were processed and analyzed for the effects of the environment and space on diatom communities.

Following sample enumeration and identification a depth-constrained cluster analysis (CONISS) and principal components analysis (PCA) were used to delineate three diatom community zones; the benthic zone 1, the benthic zone 2, and the planktonic zone. An analysis of similarity showed that these community zones were statistically significant.

Non-spatial redundancy analysis (RDA) found that depth was highly significant predictor of community organization in Gall Lake. Spatial influence was found by creating orthogonal polynomials and eigenvector maps which were tested for significance in spatial RDAs. Variance partitioning through partial ordination were performed on depth and each of the significant spatial variables. It was found that depth accounts for ~18% of the variance, ~4% was explained by covariation between depth and space, and the independent spatial signal was negligible suggesting dispersal does not affect diatom community organization at a local level. A large amount (~78%) of variance, however, was unexplained in our analysis suggesting other environmental variables are affecting diatom community organization.
Universal model for inferring past lake-water organic carbon concentrations from sediments in northern lakes using visible-near-infrared spectroscopy

Carsten Meyer-Jacob, Queen’s University

Organic carbon (OC) concentrations in lakes and rivers play a fundamental role in aquatic ecosystems by influencing physical and chemical water properties (e.g., acidity, light/heat penetration, dissolved oxygen levels), and consequently the structure of biological communities (e.g., diatoms, chrysophytes, cladocerans, and fish). Changes in biological communities in response to, e.g., climate change, recovery from acidification, or changing land use can be biased by the confounding effects of concurrent changes in OC, stressing the need for long-term OC reconstructions on the scales of centuries to millennia. Recent paleolimnological studies have shown that it is possible to infer past lake-water OC levels from lake-sediment records using visible-near-infrared (VNIR) spectroscopy.

Here, we present a universal Partial Least Squares regression model for inferring lake-water OC levels in northern lakes. This model is based on VNIR spectra of surface sediments and corresponding lake-water OC measurements from 350 Arctic, boreal and northern temperate lakes from Canada, Greenland, Sweden and Finland (0-41 mg OC L\(^{-1}\), \(R^{2} = 0.56\), \(RMSE_{cv} = 4.5\) mg OC L\(^{-1}\)). This model enables the reconstruction of past OC dynamics in areas where regional training sets do not exist. To identify common trends across SE Canada, we applied this model to dated sediment records from lakes across Ontario and Nova Scotia. The inferred long-term OC dynamics show a strong response to changes in atmospheric acid deposition that led to a decline in OC of up to 50% during the early to mid-20th century and a recovery of OC towards pre-industrial levels since the 1970’s.

Session 4:
Assessing the Toxicity of Lake Sediments Contaminated by Gold Mining Activities

Cynthia Cheney, University of Ottawa

Mining operations can be a driver of economic success for a community, but once operations cease, a legacy of contamination is typically left behind. Such is the case at Giant Mine in Yellowknife, NWT. Operating from 1948-2004, Giant Mine released 20,000 tonnes of particulate arsenic trioxide to the atmosphere, which was consequently deposited onto the landscape surrounding the mine lease territory. In Pocket Lake, located 1 km downwind from the roasting stack, a functional loss of Cladocera was recently reported, with no recovery seen in lake sediment records. In this follow-up study, we examine the cause of this extirpation event by quantifying total arsenic concentrations in porewater using ICP-MS analysis, and compare these concentrations with microbial bioavailability using a microbial bioassay. In addition, Daphnia collected from local lakes will be exposed to Pocket Lake sediments to assess the impact sedimentary exposure has on the health of the organisms. Examining multi-trophic level responses to contaminant exposure will increase our understanding of the impact of mining operations to the landscape, and will help predict what conditions are needed to expect a recovery in this ecosystem.

Paleolimnological Assessment of Algal Production during the Holocene Thermal Maximum from the Sediment Record of a Boreal Lake in Northeast Ontario

Brett Elmslie, Queen’s University

The Holocene Thermal Maximum (HTM) was a period of enhanced warmth during the early-to-mid Holocene largely caused by enhanced solar insolation. In northwest Ontario the HTM was
characterized by a lower abundance of Picea pollen and an increase in Cupressaceae and Ambrosia pollen. Pollen-based inferences suggest HTM temperatures were elevated by approximately 1-2°C and lake levels were regionally lower, suggesting conditions were arid and warm. This warming resulted in an increase algal production and associated cyanobacteria blooms in lakes in northwest Ontario. In northeast Ontario a study conducted by Liu (1990) found evidence that suggests the boundary between the boreal forest and Great Lake-St. Lawrence ecotone was displaced during the HTM. This displacement is thought to be a result of a warmer climate, but there is debate if this period was warm and humid, or warm and arid. To date, there has been little research on the impact of the HTM on the freshwater conditions of boreal lakes in northeastern Ontario, creating a gap in our understanding of large changes in climate on aquatic ecosystems. My research aims to determine if the warmer conditions of the HTM resulted in changes in primary production in a boreal lake from northeast Ontario. This was done by analyzing proxies of past production including diatom assemblages and sedimentary pigments from Charland Lake, located near Timmins, ON. Diatom assemblages have shown large ecological shifts in lake conditions over the last 8,000 years. Further discussion of inferred results will be discussed at the conference.

Capturing the influence of wildfires on mercury loading to northern lakes and peatlands using a paleolimnological approach
Nicolas Pelletier, Carleton University
Northern soils and biomass have accumulated large amounts of metal contaminants since the industrial revolution. Heavy metals previously accumulated in soils and biomass can be remobilized by wildfires and deposited in aquatic environments by atmospheric transport or subsequent catchment erosion. Because wildfire frequency and intensity are predicted to increase in northwestern Canada in response to climate change, understanding the impact of wildfires on freshwater ecosystems is important to improve our ability to predict and mitigate climate change. We explore the hypothesis that forest fires are a significant source of mercury to Northwest Territory lakes using a paleoenvironmental approach. We reconstructed mercury deposition and forest fire history in three dated lake sediments cores and two dated peatland cores from the Great Slave Lake region in the southern Northwest Territories. Ombrotrophic peatlands solely record the influence of atmospheric depositions, whereas lake sediments also record the effect of increased catchment erosion that usually follows a wildfire. Wildfire history was inferred through macroscopic charcoal analysis and trace mercury concentrations in the sediments and peat were measured with a Direct Mercury Analyser. Our preliminary results show the rate of mercury accumulation is higher in lakes than in peatlands and that the effects of wildfires are more important in lakes than in nearby peatlands, suggesting that catchment erosion processes dominate the mercury fluxes from wildfires. Wildfires of the last few decades had a larger effect on mercury fluxes than previous fires, suggesting that future wildfires may play an increasingly important role in northern lake’s mercury cycling.

Ecological consequences of 50 year of arsenic emissions on lakes around Yellowknife, Northwest Territories
Branaavan Sivarajah, Queen’s University
Giant Mine in Yellowknife (Northwest Territories) which operated between 1948-2004, is an extreme example of a large-scale mining operation, as it produced ~220 tonnes of gold along with ~20,000 tonnes of toxic arsenic trioxide dust as a by-product into the environment. Presently, the arsenic concentrations of many lakes around the City of Yellowknife exceed the
maximum allowable concentrations for drinking water (well above 10 µg/L), and are therefore a potential threat to human health, as many of these lakes are used for recreational purposes. We are using paleolimnological tools to assess the cumulative impacts of arsenic exposure and other concurrent environmental stressors (e.g. climate change, land-use changes in Yellowknife) on the biota of freshwater ecosystems along spatial gradient around Yellowknife. By examining sedimentary biological assemblages in a broad spatial set of lakes at differing distances from the Giant Mine point source, we attempt to assess the ecotoxicological effects of arsenic and other concomitant stressors on the aquatic biota in this climatically-sensitive subarctic environment. Our results show substantial differences in diatom (siliceous algae) assemblages among lakes with varying arsenic concentrations. However, multiple environmental stressors such as regional climate warming and land-use changes, are also simultaneously influencing the diatom assemblages of these arsenic contaminated lakes around Yellowknife.