Undergraduate Poster Symposium Abstracts:

Geomorphic and palaeohydraulic reconstruction of glacial Lake Edmonton, Alberta, Canada

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Glacial Lake Edmonton was a short-lived proglacial lake that formed in central Alberta during the retreat of Laurentide Ice Sheets (LIS) southwestern margin. Although this lake considerably altered the geomorphology of the region, there is a scarcity of research relating to its genesis and the palaeohydraulics of its drainage. This study uses new high resolution (15 m) LiDAR imagery to identify the geomorphic features (glaciolacustrine deposits, proglacial deltas, and spillways) from which the spatially and time transgressive evolution of the lake can be reconstructed. We identify five stages of lake evolution, the most extensive of which drained catastrophically through the previously identified Gwynne outlet. We use a HEC-GeoRAS/HECRAS system in conjunction with palaeostage indicators to estimate the steady-state water surface elevation from the main Gwynne outlet. We then use previously derived associations between lake volume and peak discharge and compare the results with peak discharges derived from spillway incision. Adjusting for downstream attenuation, results from both methods are concordant. We suggest the most extensive Gwynne stage, covering 3000 km2 with an outburst volume of 37 km3 of water, had an estimated peak discharge of 70,000-190,000 m3 sec-1 . The reconstructed flow conditions coupled with lake volume reconstructions suggest a minimum flow duration of 2-6 days. These results give the first insight into glacial Lake Edmonton's palaeohydrology, and add to the glaciolacustrine history of the Edmonton region that has not been formally revisited for over 50 years.

Isotopic Fingerprinting Identifies Anomalous Production Behavior in Winnipegosis Formation, Steelman Field, SK

J. Eadie

The Devonian Winnipegosis Formation reef buildups within the Williston Basin have proven to be prolific oil producers since the late 1980's. However, there are known issues with some Winnipegosis oil wells exhibiting anomalous production behaviour, such as reaching uneconomic water/oil ratios ('watering out') abnormally quickly. The chemistry of produced formation waters has traditionally proven unreliable in fingerprinting anomalous produced formation fluids, due mainly to the significant similarities in the chemistry of deep Paleozoic aquifers. Alternatively, it has been shown that stable isotope techniques are superior at effectively fingerprinting formation fluids in hydrocarbon exploration and production operations. In this study the hydrogen and oxygen isotopic compositions of water produced from the Winnipegosis Formation are reported from the Steelman Field, Saskatchewan. We found that the isotopic data in conjunction with production data show many cases in which oil wells exhibiting anomalous production behaviour are co-producing stray waters from outside the zone of interest. The proper identification of stray formation fluids can greatly aid in understanding reservoir characteristics, locating oil/water contacts, and improving the economics of wells by detecting potential leakage and reducing the amount of produced water.

The Pleistocene-Holocene transition as recorded in relict permafrost from central Yukon

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The late Pleistocene – early Holocene transition was characterized by rapid environmental change in central Yukon Territory, Canada. However, ecological changes during this transition are not well understood. Arctic ground squirrel nests preserved in Klondike region permafrost contain plant macrofossils and insect remains indicative of paleoenvironmental change during this period. In this study, water isotope analysis, radiocarbon dating, and taxonomical classification of plant macrofossils were conducted on ground squirrel nests and Klondike permafrost to investigate ecological changes over the Pleistocene-Holocene transition. ^{18}O and ^{2}H profiles indicate a dramatic increase in temperature over the course of permafrost aggradation consistent with previous research in this region. Different taxa of seeds, grasses, fungal spores, *Coleopteran* parts, and Oribatid mites were found throughout the samples suggesting a change in environmental composition. Several macrofossils were processed for radiocarbon dating to provide a chronostratigraphic framework for taxonomical and isotopic data. This work provides the foundation and context for other proxies to be used on the Klondike area during this transition and can help further our understanding.

Characteristics of Particle Motion beneath Shoaling Internal Solitary Waves

L. Buchart

Laboratory experiments are conducted to analyze particle motion beneath shoaling internal solitary waves (ISW). Waves are generated in a two-layer fluid using the lock release method. Lock depth (Hl) and slope angle are altered to observe differences in ISW speed, amplitude, width, upslope velocity, downslope velocity, particle velocity, and pycnocline movement. In most experiments an increase in lock depth corresponds to larger amplitudes, lesser widths, and greater velocities. Pycnocline drawdown distance correspond to greater drawdown velocity. Upslope velocities changes are small across all experiments. The Shields Parameter is calculated over time using probe velocity date. A critical threshold for the Shields Parameter is generated over a range of initial conditions to differentiate between zero bed-load transport and particle motion. The ratio between Stokes settling velocity and vertical motion (W) is analyzed to look at particle resuspension. A critical threshold of W is generated to differentiate between no vertical motion of particles and particle resuspension. Lastly, the experimental results are compared to predicted values for the amplitude, half-width, and speed in order to test the validity of the wave tank experiments. From experimental data results indicate an increase in lock depth corresponds to a decrease in time and distance from wave generation to bed-load motion and particle resuspension. An increase in the topographic slope corresponds to an increase in the time and distance from initiation.

Canadian Experiences of the May 18th 1980 Mount St. Helens Eruption.

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On May 18th 1980 Mount St. Helens had its most significant eruption in modern times. The extent and effects of the ash fallout from the eruption impacted Canada but there is a paucity of data on how far north the ash fell and how Canadians experienced this eruption. An extensive analysis of archived newspapers and the literature on the eruption was used to compile a database to achieve two main objectives: 1. Reconstruct the areal extent of the ash fall into Canada. 2. Understand how Canadians were affected by the eruption, with an emphasis on potential physiological effects. Initial results indicate that the most significant amounts of ash fell (~0.5-1 mm) from the Kootenays in southeastern BC, across Claresholm and Medicine Hat in Alberta to the Cypress Hills in Saskatchewan. The most heavily affected area was southern Alberta around Lethbridge, Pincher Creek, Cardston and Waterton Lakes National Park. Reports indicate that trace amounts were recorded across a much wider area, From the Okanagan in the west, as far north as Calgary and east towards Regina. The ash fallout was not as severe in the provinces as in the states below, as in the U.S. there were fatalities while none occurred in Canada. The primary concerns were effects on the agriculture industry (e.g. acidity spike, crop damage), and respiratory health, with secondary concerns regarding transportation and visibility, however the actual impact was minimal. It is unclear how widespread the ash fall was, and a public survey is currently in circulation that will build upon, and compare to, the results presented herein

SWIR investigation of clay minerals in a high sulfidation system at Red Mountain, Arizona

J. Pearson, P. Lecumberri-Sanchez

Porphyry systems are the primary source for metals like copper, molybdenum and a significant source of gold and silver. The demand for these base and precious metals has increased exponentially with the green revolution and increasing population. In parallel, new discoveries of outcropping deposits have become less and less common leading to the exploration for deeper targets. The alteration assemblages in porphyry systems (argillic, phyllic, propylitic and potassic) are systematically distributed within in space and can therefore be used in exploration. Conventional core logging does not typically allow identifying fine grained mineralogy (e.g., phyllic and argillic alteration) or the compositional variability of minerals within a system. My project uses short wave infrared spectroscopy (SWIR) on drill core to map chemical changes of white mica species within a porphyry system with vertical exposure of ~2 km. Analyzing the dioctahedral micas in the electron microprobe and comparing the data to deviations in the characteristic Al-OH absorption feature at 2200nm, we are aiming to identify compositional changes that are systematic with depth. This offer the potential, if such a relationship exists, to vector towards ore bodies in the subsurface which can be used in combination with conventional techniques in early exploration drill programs.

Meaningful Inclusion of Young people in public engagement

F. Elkadry

The places in which we live, work, and play have an intrinsic effect on our health and well-being. City planners aim to create vibrant and functional spaces to improve our quality of life. Planning professionals use public engagement processes to inform and learn from citizens. In my thesis, I study the extent of which young people, aged 6-17, are meaningfully included as participants at public engagement events. Although young people experience the city every day, their voices are often left out of public engagement.

I observed two public engagement events hosted by the City of Edmonton that were marketed as 'Family Friendly'. I interviewed families that attended to understand the experiences of young people. I also interviewed City of Edmonton staff that organized and worked at the events. I found that the event space influenced the engagement experience of attendees. Although all people, regardless of age, were welcome to engage, there was a separation of spaces within the events. This included a delineated Kids Zone, which attracted young people and their parents into the engagement space. By observing others around them, attendees were able to understand how to behave in the space. A major conclusion of my research is that the separation of spaces based on age group hinders young people from the act of engaging. This results in an exclusion of their experiences and ideas, leading to city plans that are not well informed by young people themselves.

Paleoproterozoic granites at Nonacho Lake, NWT: A newly reported occurence of Arrowsmith age magmatism in the Rae Province

E. Creaser

The Rae province is an Archean craton centred within the Laurentia supercontinent. The craton's western margin experienced a complicated tectonic history throughout the Paleoproterozoic, with one major event being the Taltson-Thelon Magmatic Zone (TTMZ). This tectonic event comprises extensive metamorphism and 1.99-1.91 magmatism. There is evidence for an older orogenic event along this margin, though partially overprinted by the TTMZ, called the Arrowsmith orogeny. This orogenic event comprises ca. 2.4-2.3 Ga magmatism and metamorphism, and it is recorded from Baffin Island to northern Saskatchewan. This thesis recognizes a new occurrence of ca. 2.3 Ga granitic magmatism at Nonacho Lake in the southwest of the Rae province. U-Pb zircon crystallization ages were determined for two different monzogranite bodies and a monzogranitic dyke. Overall, the ages for these granites are ca. 2.4-2.3 Ga. The foliated monzogranite (EC02C) has a complex concordia data set with evidence of xenocrystic zircons and younger lead loss events, and has an interpreted crystallization age of 2304 ± 84 Ma. The massive monzogranite (EC03A) is 2383 ± 43 Ma, and the monzogranitic dyke (EC02E) is 2328 ± 63 Ma. These granites have a wt% SiO_2 greater than 70%, so are classified as high silica granites. Major and rare earth geochemistry plots suggest that the two monzogranite suites originated from a volcanic arc tectonic setting, while the monzogranitic dyke is related to a within plate setting. Both geochemical data and crystallization ages for these granites support this thesis' proposal that they formed during the ca. 2.3-2.4 Ga Arrowsmith orogeny.

Sphalerite-forming fluids: Brine and petroleum in the Pine Point District

M. Szmihelsky

Mississippi-Valley Type (MVT) deposits are some of the world's most important resources of Pb and Zn, one of the largest MVT deposits being Canada's Pine Point Pb-Zn District. The origin of MVT deposits lacks consensus, including questions surrounding their deposition and ore-forming fluids. Here, we study sphalerite, marcasite, and dolomite mineralization at Pine Point to constrain the chemistry of sphalerite-forming fluid and to provide insight into the relationship between marcasite and other ore minerals. A petrographic analysis of marcasite indicated that euhedral marcasite, when present, occurs early in the paragenesis, and disseminated marcasite is present in late-stage dolomite; both morphologies exhibit replacement by sphalerite, possibly acting as a source of sulfur in sphalerite deposition. Salinities and elemental concentrations of the sphalerite were determined. Microthermometry results yielded highly saline brines as sphalerite-forming fluids: homogenization temperatures ranged from 50 to 115 °C, ice melting temperatures were recorded from -43.8 to -7.9 °C, and hydrohalite melting was recorded between -18.6 and -21.9 °C. From these data, salinities were calculated and ranged from 20 to 40 eq. wt% NaCl. Chemical analysis of fluid inclusions found Na, K, Ca, Mg, Sr, Pb, and Rb in varying concentrations. Sphalerite exhibits varying concentrations of Mn, Fe, and Cu, possibly causing colour zonation. Through fluid inclusion petrography, we also show that petroleum was present during sphalerite deposition. These results suggest a range in fluid chemistry and provide evidence for deposition by petroleum, contributing to a more comprehensive depositional model for Pine Point and MVT deposits as a group.

Characterization of permafrost cores from the Inuvik-Tuktoyaktuk Corridor

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Thawing permafrost poses a significant threat to geochemical, hydrological and ecological stability of northern environments; it can dramatically damage infrastructure, including roads. Permafrost, ground that remains frozen for a minimum of two years, underlies most of northern Canada. To better understand permafrost and paleoenvironmental conditions near the Inuvik-Tuktoyaktuk Highway (ITH), this study analyzed three cores (BH-1, BH-4, and BH-8) collected at peatlands ~20, 44 and 75 km north of Inuvik to a depth of 11.2, 7.7 and 11.4 m, respectively. Cores were analyzed for cyrostructures, organic content, water isotopes (δ18O and δ2H) and underwent radiocarbon dating to determine the origin of the sedimentary records and associated ground ice. The cores record a variety of ice-rich depositional environments. Ice-rich diamictons near the base of the BH-1 and BH-4 cores have δ18O water isotope values of -18 to -20 ‰ with a co-isotope slope less than the local meteoric water line (LMWL) suggesting they havebeen modified by thaw and refreezing. A 4 m thick massive-ice body in BH-1, with a Holocene age near its surface, has water isotopes which fall on the LWML, suggesting the preservation of buried snow. Radiocarbon dates and sedimentary structures within silt and-clay deposits at the base of BH-8, indicate the presence of a local lake from ~11,500 to 9000 years ago followed by its drainage, development of epigenetic permafrost, and a shift to syngenetic peat. Collectively, these deposits-suggest preservation of a relict permafrost landscape affected by thaw in the early Holocene, with subsequent stabilization and permafrost aggradation.