Earth Sciences Graduate Symposium 2026

Program with Abstracts

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April 13th, 2026

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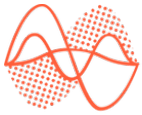

MIRF
Manitoba Isotope Research Facility

University of Manitoba
Department of Earth Sciences

ESGS 2026 Program

Monday April 13th, Klaus Hochheim Memorial Theatre (545 Wallace)

10:55	**Welcome:** Kirstin Brink, graduate chair
11:00	**Osei Boakye, Nancy:** Isotopic insights into the cycling of terrestrial-sourced dissolved organic carbon in Southern Hudson Bay/James Bay
11:15	**Costa, Bruno:** Shark Biodiversity and Ecology: Niche Partitioning in Vertebrates of the Cretaceous Western Interior Seaway
11:30	**Strickland, Kelsey:** Reconstructing the diet of *Enchodus* through isotopic analysis of tooth enamel
11:45	**Thompson, Mira:** Re-evaluation of megaherbivore faunal turnover in the Dinosaur Park Formation, Alberta using a newly resolved biostratigraphic framework
12:00	**Hussain, Maria:** A lifetime of listening: mining related environmental contamination in fish otoliths across trophic levels
12:15	**Lunch:** Cross Common Room, St. John's College
1:30	**Bandara, Dilshini:** Interaction of Metals with Mineral-Organic Matter Associations in Contaminated Environments
1:45	**Sharpe, Ryan:** Lithium Isotopic Analysis of Spodumene by Secondary Ion Mass Spectrometry
2:00	**Wathsala, Thilini:** Redox Evolution and Organo-Mineral Interactions in Organic-Rich Marine Shales from the Lusitanian Basin, Portugal: Evidence from Pyrite Framboids and Illite–Magnetite Associations
2:15	**Rathnayake, Sathma:** Petrographic and Geochemical Constraints on the Evolution of the Lucy LCT Pegmatites, Falcon West Property, Manitoba, Canada
2:30	**Snider, Urgon:** Diversity and trophic systems of the Late Ordovician: the role of small carbonaceous fossils within the carbonate system of North-Central Manitoba
2:45	**Coffee:** Earth Sciences Faculty Lounge
3:15	**Ugwu, Ezinne:** Evaluating a 1D airborne electromagnetic inversion workflow using well-log-derived resistivity proxies
3:30	**Sogoba, Djelika**: Mineralogy of silver in the five-element veins, Cobalt Embayment, Ontario, Canada
3:45	**Goonetilleke, Muditha**: Hysteresis evidence for non-steady state carbon cycling during the Early and Middle Jurassic
4:00	**Joubarne, Tristan:** Soft tissue preservation and integumentary structures of a juvenile hadrosaurid from the upper Campanian Dinosaur Park Formation of Alberta, Canada
4:15	**Samaradiwakara, Sisara**: Topographically controlled Deposition and Mobility of Metal Contaminants around a Pb smelter
4:30	**Mulcahy, Jack:** Geochronology of Pegmatites Associated with Critical Metals, Nova Scotia, Canada
5:00	**ESGS Closing Banquet, Earth Sciences Faculty Lounge (invite only)**

Isotopic insights into the cycling of terrestrial-sourced dissolved organic carbon in Southern Hudson Bay/James Bay

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Stable carbon isotopes ($\delta^{13}C$ signatures of organic carbon) are useful as tracers in coastal marine environments because they can distinguish terrestrial and marine sources, allow source apportionment of mixtures, and indicate via nonconservative mixing relationships the significance of fractionation processes associated with organic carbon transformation.

The Southern Hudson Bay/James Bay system, which borders the massive peatlands of the Hudson Bay Lowlands, is a mixing zone of organic material sourced from diverse terrestrial (riverine) sources and marine primary production converging within a single system. The diversity of sources and freshwater residence time complicates identification of dominant sources of dissolved organic carbon (DOC). Quantitative source apportionment via optical tracers has not been possible; bulk properties have provided limited insight into the DOC removal and addition processes operating within the system. This study uses $\delta^{13}C$-DOC and bulk DOC concentration to evaluate DOC mixing behavior along estuarine salinity gradients (0 – 25) and compares concentration-based and isotope-based approaches in constraining DOC sources and transformations.

A two-endmember mixing model was applied using both DOC concentrations and $\delta^{13}C$-DOC values. The DOC concentration model showed a wide range of values in the terrestrial endmember (i.e., riverine DOC concentration) that narrows with increasing salinity towards the marine endmember. The DOC mixing line overall exhibits near-conservative behaviour suggesting that physical mixing is the dominant control on DOC distribution. This predictable variation between endmembers indicates limited evidence for net addition or removal within the system. In contrast, the isotope-based model shows a different pattern. The terrestrial endmember displays $\delta^{13}C$ signatures with low and, in some cases, river-specific variability, consistent with reported regional values (−27.06‰ to −28.97‰). The $\delta^{13}C$-based model indicates that bulk DOC is predominantly terrestrial (~90%) at low salinities (0–15), decreasing to approximately 10–30% terrestrial contribution at salinities above 30. Measured $\delta^{13}C$-DOC values are generally more ^{13}C-depleted than predicted by conservative mixing, indicating a persistent influence of terrestrial organic carbon and suggesting that DOC composition is being systematically altered without significantly changing bulk concentration.

Overall, the Southern Hudson Bay/James Bay system exhibits mixing-dominated DOC behavior, while retaining underlying complexity in carbon sources and transformations. This underscores the value of isotopic tracers in identifying processes that remain unresolved when relying on concentration data alone.

Shark Biodiversity and Ecology: Niche Partitioning in Vertebrates of the Cretaceous Western Interior Seaway

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The Late Cretaceous Western Interior Seaway (WIS) of North America hosted a diverse array of marine vertebrate taxa, such as mosasaurs, plesiosaurs, turtles, sharks, bony fish, and birds. Evidence shows that the WIS was impressively dynamic and varied, both environmentally and biogeographically, and provided numerous niches for marine biotas to occupy. Recent studies analyzing plesiosaur and mosasaur teeth and jaws suggest clear evidence of niche partitioning, indicating that both groups targeted specific prey to avoid competition, although some prey flexibility and overlap would still be possible.

However, the role of sharks and niche partitioning with marine reptiles in the WIS remains unknown. For this study, we compiled a dataset through space and time of all shark occurrences known from the WIS, including newly discovered shark specimens from southwestern Manitoba. Taxa were categorized into different ecological groups based on tooth and, when preserved, skeletal anatomy. Results show a variety of macrophagous apex predators, mesopredators, scavengers, and planktivorous filter-feeders with changing co-occurrences through time. Between the Cenomanian-Coniacian, sharks generally occupy higher trophic levels, whereas from the Santonian-Maastrichtian, sharks occupy overall lower trophic positions. This new understanding of shark ecology and niche occupancy in the WIS will enhance our understanding of the faunal composition and trophic structure of non-analog ancient marine ecosystems and bolster our understanding of shark survival and resilience throughout extinction events.

Reconstructing the diet of *Enchodus* through isotopic analysis of tooth enamel

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The Western Interior Seaway (WIS) was a large inland sea that divided North America into two land masses, extending from the Arctic ocean to the Gulf of Mexico during the Late Cretaceous. During this period, the WIS supported a large diverse range of marine life, including marine reptiles, birds, sharks, and bony fish. Although particular attention has been paid to understanding niche partitioning amongst the large marine reptiles, an understanding of the ecology of the bony fish and their role in the trophic structure of the WIS is still unknown. To address this, we will focus on the extinct ray-finned fish *Enchodus*. This fish ranged in size from a few centimeters to over a metre in length, with distinctive fangs measuring up to five cm in the largest specimens. Teeth of *Enchodus* representing different size classes has been recovered from the Pierre Shale deposits outcropping in southwestern Manitoba. For this study, carbon, oxygen and strontium isotopic composition of the enamel from the teeth will be analyzed because they are

good indicators of diet in extinct marine animals. To measure the isotopic composition, the thin layer of enamel was removed and prepared for stable isotope ratio mass spectrometry (SIRMS) and secondary ion mass spectrometry (SIMS). Results will determine if there were differences in diet between different sized fish and if diet changed throughout growth. The findings of this study will help better understand the ecological dynamics of the WIS during the Cretaceous.

Re-evaluation of megaherbivore faunal turnover in the Dinosaur Park Formation, Alberta using a newly resolved biostratigraphic framework

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Biostratigraphic research in the Campanian Dinosaur Park Formation (DPF) in Dinosaur Provincial Park (DPP), Alberta has focused on megaherbivore dinosaur fossil assemblages, which appear to differ up section. This indicates a faunal turnover in the DPF environment through time. The exact timing and cause of this faunal turnover remains unclear due to the uneven thickness and horizontal extent of DPF fluvial strata. Thus, a stratigraphic framework based on dated marker beds and detailed fluvial stratigraphic observations is necessary to resolve DPF dinosaur biostratigraphy. Research on DPF bentonites in DPP has dated and correlated the Plateau Tuff bentonite (PT; 75.639±0.025 Ma). To test the utility of the PT as a marker bed, we focus on several megaherbivorous dinosaur fossil sites preserved in channel-belt sandstone deposits located near PT outcrops. Field stratigraphic sections and drone derived digital stratigraphic sections were measured to correlate of channel-belt deposits and stratigraphically place of fossils. Stratigraphic placement of dinosaur fossils using our methods differs considerably from elevation-based methods, producing a biostratigraphic succession for the DPF that is a significant departure from previous studies. Specifically, several species of megaherbivorous dinosaurs previously thought to live at different times likely briefly coexisted. This has substantial implications regarding evolutionary hypotheses, such as anagenesis or cladogenesis, in dinosaur lineages. We also observe fewer megaherbivore species in strata above the PT compared to below the PT. Our work demonstrates that age constraints and detailed analysis of fluvial stratigraphic architecture are necessary to accurately place fluvially preserved fossils into stratigraphic context.

A lifetime of listening: mining related environmental contamination in fish otoliths across trophic levels

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Flin Flon, a city in northern Manitoba, hosted nearly a century of base-metal mining and smelting that produced zinc (Zn) and copper (Cu), resulting in long-term contamination of nearby ecosystems. Although mining ceased in 2022, its environmental impacts persist. In 2024, the Government of Manitoba issued a selenium (Se) advisory for fish in Schist Lake after detecting elevated Se levels relative to previous years. Selenium is an essential trace element and a common byproduct of mining, but in excess it can be toxic to fish and humans. The temporal and trophic level history of Se exposure in Schist Lake fish remains unknown. To address this, we investigated how Se contamination varies through time and trophic levels and whether otolith chemistry can reconstruct this history.

Contra muscle tissue, otoliths preserve a chronological, lifetime record of environmental exposure. We examined otoliths from three trophically distinct species collected in 2022 and 2025: Lake Cisco (mid-level planktivore), Yellow Perch (upper-level omnivore) and Northern Pike (top predator). Laser-ablation inductively coupled plasma mass spectrometry line transects were used to quantify Zn and Se concentrations across otolith growth increments. Zn profiles exhibited expected patterns, including enriched nuclei and cyclical annual signals. Lake Cisco and Northern Pike exhibited late-life Se peaks, suggesting the area of capture is a selenium contaminated site. However, Yellow Perch do not show the same end of life peak, indicating the differences may be related to trophic position, or species variation in sensitivity to contamination.

Interaction of Metals with Mineral-Organic Matter Associations in Contaminated Environments

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Physiochemical interactions between minerals and organic matter are prevalent in surficial soils and pore – and surface waters. This interaction led to mineral-organic matter associations (MOAs), in which either lighter, more mobile organic matter binds to mineral surfaces or minerals form within the pore spaces of particulate organic matter. In both cases, polar functional groups of the organic matter are prevailing at the organo–mineral interface. MOAs can sequester metal contaminants such as Cu, Ni, Pb, Cd, As, and Cr in their respective environmental settings. This sequestration process is governed by adsorption, co-precipitation, occlusion, redox reactions, catalysis, and dissolution. The interaction of metals with MOA can result in the formation of ternary complexes, such as mineral-metal(loid)-OM or metal(loid)-OM-mineral associations, or the formation of metal nanoparticles within OM or along the OM-mineral interface. A better understanding of the occurrences and associated forms of these metals in soils, pore waters, and surface waters is needed to understand contaminant retention in complex systems. The characterization of metal(loid) speciation in MOAs, however, requires a multi-analytical approach that may include techniques such as FTIR, XRD, UV/vis spectroscopy, TEM/SEM imaging, and Electron Energy-Loss spectroscopy. The latter technique allows us to characterize the abundance of polar functional groups in metal-bearing MOAs at the

nanometer scale. It thus provides information on how contaminants may modify the structure and composition of MOAs during their uptake.

Lithium Isotopic Analysis of Spodumene by Secondary Ion Mass Spectrometry

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Spodumene is the primary ore mineral in many economically important hard-rock lithium deposits (e.g., pegmatites). Lithium (Li) stable isotopes provide insight into fluid–rock interaction and magmatic differentiation, but their accurate determination in spodumene requires well-characterized, homogeneous reference materials for secondary ion mass spectrometry (SIMS).

In this study, in situ Li isotopic analyses were performed on eight spodumene samples (UM1–8) with variable chemical compositions using a CAMECA 7f SIMS instrument. Analytical protocols were systematically varied to evaluate the effects of instrumental conditions on precision and matrix-dependent mass fractionation. Specifically, analyses using a 0 V sample voltage offset with Faraday cup detection were compared to those using a −40 V offset with an electron multiplier. The two analytical protocols produced similar precision (~0.60‰; 2SD) but yielded markedly different matrix effects. Analyses performed with a −40 V offset exhibit matrix effects that strongly correlate with Fe content in spodumene, whereas analyses using a 0 V offset show no resolvable matrix effects.

These results demonstrate that SIMS can achieve a precision of ±0.60‰ (2SD) for δ^7Li in spodumene while minimizing matrix effects under optimized conditions. Application of this method to spodumene from pegmatites in the Brazil Lake (Nova Scotia) and Snow Lake (Manitoba) regions reveals distinct isotopic signatures, with mean δ^7Li values of 0.56‰ and −1.23‰, respectively. These differences highlight the potential of Li isotopes in spodumene to discriminate between pegmatite sources and evolution.

Redox Evolution and Organo-Mineral Interactions in Organic-Rich Marine Shales from the Lusitanian Basin, Portugal: Evidence from Pyrite Framboids and Illite–Magnetite Associations

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Organo–mineral interactions play an important role in the preservation of organic matter (OM) and the sequestration of redox-sensitive elements during the early diagenesis in marine sedimentary environments. Major objectives of the study are to evaluate how mineral-organic interactions affect the stabilization of organic carbon and to reconstruct

the redox conditions during deposition. This study investigates the morphology, size distribution, and microscale mineral associations of pyrite framboids, and nanoscale observations of illite clay minerals, and magnetite nanoparticles found in organic-rich marine shales from the Água de Madeiros Formation in the Lusitanian Basin, Portugal. Scanning electron microscopy (SEM) analysis revealed framboidal pyrite with an average diameter of 2–8 μm. These occur mainly as polyframboidal aggregates composed of morphologically rounded framboids interconnected by randomly oriented microcrystals. The predominance of small framboids and limited variability in size suggest formation under euxinic conditions, probably within the water column or just below the sulphate-reduction zone shortly after sediment deposition. Transmission electron microscopy (TEM) confirmed the presence of spheroidal framboidal aggregates with fine-grained internal textures at the nanoscale. Elemental analyses showed that Fe and S were the main components. Minor amounts of oxygen detected within some framboids can indicate localized post-depositional oxidation or redox fluctuations during burial diagenesis. TEM observations also revealed abundant illite clay minerals hosting magnetite nanoparticles at the nanometer scale, with the average size range of 5–6 nm. Magnetite occurs as small particles that are closely associated with illite interlayers and organic-matter-rich domains, suggesting in-situ precipitation under anoxic to suboxic pore-water conditions during early diagenesis. The close spatial relationships between pyrite framboids, illite, magnetite, and organic matter indicate a hitherto unknown coupled iron–carbon cycling at the nanoscale. The observed organo–mineral associations suggest that sulphide mineralization and clay-mediated encapsulation of organic matter may have restricted microbial degradation and enhanced long-term preservation of organic carbon. Overall, combined micro- to nanoscale observations indicate euxinic depositional conditions followed by localized redox variability during burial diagenesis. Ongoing studies focused on the occurrence of pyrite framboids together with illite–magnetite–organic matter nanocomposites, may provide important proxies for reconstructing redox evolution and understanding the mechanisms of organic carbon stabilization in organic-rich marine shales.

Petrographic and Geochemical Constraints on the Evolution of the Lucy LCT Pegmatites, Falcon West Property, Manitoba, Canada

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The Lucy pegmatite is located within the Falcon West area of southeastern Manitoba along a major tectonic boundary between the Winnipeg River and Wabigoon Subprovinces of the Superior Province. It is a highly fractionated Lithium-Cesium-Tantalum (LCT) pegmatite emplaced within the Archean-age West Hawk Lake greenstone belt (Grid Metals Corporation 2022). Although Lucy pegmatite has been explored since 1955 with repeated drilling and resource evaluation, its petrogenesis, emplacement timing, and fluid evolution remain poorly constrained (Grid Metals Corporation 2022). This study aims to develop an emplacement and formation model through an integrated study combining petrography, mineral chemistry, geochronology, and stable isotope

geochemistry to better understand the genesis and evolution of the Lucy pegmatite system.

Preliminary petrography shows the pegmatite is dominated by coarse-grained, commonly euhedral quartz, plagioclase, and K-feldspar, with minor coarse-grained euhedral to subhedral muscovite and spodumene. The perthitic texture in K-feldspar indicates late-stage exsolution during cooling. Myrmekitic quartz-feldspar intergrowths are locally present. Accessory minerals include euhedral to subhedral tourmaline and garnet, and tourmaline displays distinct colour zoning, suggesting evolving melt composition. Paragenetic analysis identifies four stages of crystallization reflecting the progressive evolution of melt. Secondary mineral assemblages include sericite, quartz, muscovite, and spodumene showing late-stage fluid-rock interaction as suggested by fine-grained mineral growth along grain boundaries, localized grain-boundary dissolution, and sericitization of feldspar.

Proposed SEM, EMPA, U-Pb and ^{40}Ar-^{39}Ar geochronology and SIMS-based O-H stable isotope analyses will further constrain the emplacement timing and fluid evolution, contributing to the first integrated genetic framework for the Lucy LCT pegmatites.

Diversity and trophic systems of the Late Ordovician: the role of small carbonaceous fossils within the carbonate system of North-Central Manitoba

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Biodiversity saw an enormous expansion towards the Late Ordovician (453.0-443.8 Ma), where complexity within lineages accelerated worldwide. Carbonate rock outcrops across Northern and Central Manitoba highlight this proliferation, with fossilized soft tissue being described from several localities. Analysis of small carbonaceous fossils (SCFs) is an important method for understanding diversity and trophic levels within carbonate environments, as SCF's can represent broken assemblages of macrofossil elements, or entire microorganisms. SCFs from Cambrian and Early Ordovician localities have been previously sampled and prepared palynologically, with little focus on the Late Ordovician. Samples from two unique localities, Cat Head in Lake Winnipeg (Katian) and Airport Cove in Churchill (Hirnantian), were subjected to a modified acid dissolution procedure using low-concentration acetic acid, SCF's were extracted for description, diversity analysis, and mounting. Currently, carbonate thin sections were created using outcrop samples from stratigraphic intervals from Cat Head and ex-situ samples from Airport Cove. Microfacies analysis of the thin sections and determinations of total organic carbon will reveal changes in the depositional environment, including nutrient levels and water quality, within both successions. Utilizing staining methods and X-ray diffraction (XRD), mineralogical changes will be analyzed between the localities. With the results produced

from this study, the paleo ecosystem of each carbonate platform will be reconstructed, highlighting relative diversity and ecology changes between two basins within the final stages of the Ordovician. Our study will highlight the complexity of Late Ordovician SCF's in conjunction with global biodiversification sequences that occurred before the end of the Ordovician extinction.

Evaluating a 1D airborne electromagnetic inversion workflow using well-log-derived resistivity proxies

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In this study, we assessed the capability of airborne electromagnetic (AEM) method to delineate oil-sand-bearing intervals at the Clarke Creek In-situ Property by utilizing resistivity log data to construct and evaluate a synthetic 1D workflow. A 300 m well log, sampled at 2 m intervals, was converted into both a simplified 4-layer model and a detailed layered model. From these models, versatile time-domain electromagnetic (VTEM) responses were simulated, employing realistic waveforms, transmitter geometry, and 44 off-time gates.

Synthetic data, incorporating 5% Gaussian noise, was inverted using SimPEG, beginning with a homogeneous reference model. To evaluate system sensitivity, we conducted a forward-modeling detectability study by comparing the responses of target and background models across various reservoir thicknesses and overburden depths (ranging from 20 to 120 m). This analysis successfully identified the time channels most responsive to the resistive McMurray Formation, even when considering the conductive masking effects of the Clearwater shale.

The results indicate that, under ideal 1D conditions and with appropriate inversion constraints, AEM data can effectively resolve the primary resistive structure associated with oil-sand-bearing intervals. The resistive zone yields a measurable response at intermediate off-times and is represented in the inversion as a distinct, albeit smoothed, high-resistivity layer with diminished contrast.

Mineralogy of silver in the five-element veins, Cobalt Embayment, Ontario, Canada

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Silver is a major commodity in five-element veins (Ag-Co-Ni-Bi-As), whose genesis is highly debated, with genetic models involving magmatic, magmatic-hydrothermal, or hydrothermal origins; recently, methane-bearing fluids have also been proposed.

Despite the variety of models, it is undisputed that syngenetic silver formation in this deposit type is complex and may involve various mechanisms, including the presence of Ag nanoparticles (Ag NPs) that form dendritic silver. The role of low-temperature epigenetic fluids, however, is not well understood, although these processes may result in the upgrading and refining of silver in five-element deposits. This study focuses on the behaviour of silver during secondary processes in five-element vein deposits, using microanalytical methods such as reflected light microscopy and scanning electron microscopy on samples from divers location in the Cobalt Embayment, a historically rich Ag district in eastern Ontario. The current results of this study define the ore assemblage, describe the (silver) textures, establish textural relationships (silver-(sulpha)arsenide/antimonide associations) relevant to ore formation, and help select appropriate samples for further micro- and nano-analyses.

Hysteresis evidence for non-steady state carbon cycling during the Early and Middle Jurassic

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The marine dissolved organic carbon (DOC) reservoir was recognized as a first-order regulator of non-steady-state behaviour in the global carbon cycle during the Neoproterozoic. However, the magnitude and duration of the Neoproterozoic carbon-cycle disruption required an exceptionally large DOC reservoir, raising questions about its existence. While the role of marine DOC in the global carbon cycle is relatively well understood, its short-lived size and composition dynamics remain unclear, raising the question: *Did the expansion of the marine DOC reservoir cause temporary decoupling between organic and inorganic $\delta^{13}C$ records?*

We hypothesize that variations in the oceanic DOC reservoir operating at orbital timescales are sufficient to drive transient departures from steady state and generate decoupling between organic and inorganic $\delta^{13}C$ records for a few million years or less. To test this hypothesis, a hysteresis analysis was performed between carbonate $\delta^{13}C$ and $\Delta\delta^{13}C_{(carbonate\text{-}organic)}$ using published and newly compiled datasets from the ~1 Myr Early Jurassic T-OAE (Yorkshire, UK) and a ~400 kyr Middle Jurassic event (Bathonian-Callovian) in the Lusitanian Basin (Portugal). Preliminary hysteresis results of both the Early Jurassic T-OAE and the Middle Jurassic sections show counterclockwise loop geometries with gradients close to unity (i.e., $m \approx 1$). This suggests non-steady-state behaviour of the carbon cycle and a lagged response between the inorganic and organic reservoirs in the ocean. The near-unity slopes further imply potential buffering of the organic-related $\delta^{13}C$ in the ocean. Together, these results suggest that dynamic ocean organic carbon feedback is involved in both study intervals, although the mechanisms, magnitude, and persistence remain uncertain.

Soft tissue preservation and integumentary structures of a juvenile hadrosaurid from the upper Campanian Dinosaur Park Formation of Alberta, Canada

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Although rare in the fossil record, well-preserved soft tissues are relatively common in hadrosaurs. Valuable information about the external anatomy of hadrosaurs, such as integument patterns and the presence of fleshy structures, can be gained from these specimens. However, despite the relative abundance of preserved integument in hadrosaurs, the processes leading to their fossilization are poorly understood. This research aims to understand the modes of preservation of hadrosaur soft tissues. To do so, we studied an indeterminate hadrosaur, with fossilized integument, recovered from the Dinosaur Park Formation near Irvine (Alberta). Soft tissues on the hands of this specimen form a “mitten” around digits II-III-IV, and two different types of scales were observed forming vertical bands on its torso. For our study, we re-examined these tissues under UV light. Preliminary analyses revealed the presence of a hoof-like structure extending from two pedal unguals (IV [left] and possibly III [right]), reminiscent of the structures recently reported in two *Edmontosaurus annectens* mummies from Wyoming. These structures appear yellow under UV light. Preliminary analyses also reveal an orange UV fluorescence of the integument on the limbs, but not on the torso of this individual, suggesting different chemical compositions, and thus likely different modes of preservation for these soft tissues. Going forward, sedimentological analyses of the locality from which this specimen was recovered will be conducted to reconstruct the depositional environment, in combination with geochemical analyses to determine the pathways that led to the preservation of soft tissues on this specimen.

Topographically controlled Deposition and Mobility of Metal Contaminants around a Pb smelter

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Smelting activities contribute to severe metal(loid)s contamination in the soil. Particulate matter emitted from a smelter is deposited either via wet or dry deposition. Wet deposition results from the scavenging of finer, more soluble particles during precipitation events, while dry deposition occurs through the gravitational settling of coarser PM. At sites predominantly affected by wet deposition, deposited elements are commonly more mobile, whereas sites impacted predominantly by dry deposition have higher concentrations of emitted elements. There is an additional shadow effect around the smelter, where the peak of the deposition depends on the height of the smelter and occurs circa 5 km from the smelter. High-resolution soil sampling around the Pb-smelter

in Trail, British Columbia, Canada indicated that spatial distribution, deposition, and mobility of Pb, Zn, and As in the surficial soils were controlled by the valley topography. Concentrations of Pb, Zn, and As in the surficial soils and in leachates allowed us to identify sites predominantly affected by wet and dry deposition. Furthermore, they indicated that the extent of the shadow zone was controlled by valley topography, leading to a shorter shadow zone than in flat terrain. The vertical distribution of Pb, Zn, and As was governed by the type of atmospheric deposition (wet or dry) and was most likely also controlled by pH-dependent sorption, co-precipitation, or the formation of sorption complexes with Fe (hyd)oxides, as well as by incorporation into pedogenic minerals.

Geochronology of Pegmatites Associated with Critical Metals, Nova Scotia, Canada

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Pegmatites hosted within and spatially associated with the Late Devonian granitoid plutons (i.e., Barrington Passage, Mulgrave Lake, Port Mouton, and Shelburne plutons) in Nova Scotia are of interest due to their high beryllium (Be) content and may represent a locally significant resource. Previous studies have dated only a limited number of pegmatites by analyzing coarse, primary mica and do not consider minerals produced by alteration. Three textural varieties of muscovite occur in the pegmatites: 1) as coarse-grained books (Ms-1) associated with coarse quartz and feldspar, 2) fine-grained growth (Ms-2) on feldspar, particularly plagioclase, and 3) fine-grained masses of needles marginal to decomposed feldspar and mica. In pegmatites associated with the four plutons, *in situ* Ar-Ar analyses of unaltered Ms-1 cores yield ages ranging from 373 ± 1 Ma to 360 ± 3 Ma, with a Barrington Passage pegmatite yielding a significantly younger age of 336 ± 3 Ma. With the exception of the Barrington Passage pegmatite, these dates align with the waning stages of pluton emplacement. Alteration-related muscovite (Ms-3) from Barrington Passage and Shelburne pegmatites give ages ranging between 320 ± 3 Ma and 307 ± 2 Ma. Ms-3 from the Mulgrave Lake pegmatite produced an Ar-Ar age of 373 ± 1 Ma, identical to Ms-1 ages from the same pegmatite. U-Pb analysis of monazite from a Barrington Passage pegmatite gave an age of 301 ± 15 Ma, slightly younger than the Ms-3 ages from the same region but still coincident with the Alleghenian Orogeny.