2023-24 NSERC USRA PROJECTS – School of Earth and Ocean Sciences

SUPERVISOR(S):	PROJECT TITLE AND OUTLINE:	CODE:	START DATE:
Dr. Anne-Sofie Ahm Assistant Professor, School of Earth and Ocean Sciences annesofieahm@uvic.ca	**Carbon and phosphate cycling in modern alkaline lake's; analog environments for the origin of life.** This project involves fieldwork in interior BC, studying the geochemistry, carbonate sedimentology, and geobiology of modern alkaline lakes. These lakes are unique environments with modern stromatolites and high phosphate concentrations – conditions that we believe are representative of marine environments on early Earth. You would be involved with sampling sediments, microbial mats, and water from several lakes during ~2 weeks of fieldwork, likely at the end of May. Following fieldwork, you will help analyses the samples in the geochemical laboratories in SEOS, gaining valuable experience using mass spectrometers to measure stable isotopes ($\delta^{13}C$, $\delta^{18}O$) and trace element concentrations. This project is part of active research in Ahm's group and the collected data will form the basis of future honours, MSc, and PhD projects. No prior experience is required. You will receive the needed training for field and lab work. **Location** – Cariboo Plateau, interior BC. SEOS geochemistry labs.	**4013** **4011**	May 1, 2023
Dr. Haruki Hirasawa Post-Doctoral Fellow, School of Earth and Ocean Sciences **hhirasawa@uvic.ca** **Dr. Hansi Singh** Assistant Professor, School of Earth and Ocean Sciences **hansingh@uvic.ca**	**Does Marine Cloud Brightening climate intervention prevent extreme weather?** Marine Cloud Brightening (MCB) is a proposed climate intervention technique in which sea salt aerosol would be injected into marine boundary layer clouds to increase their albedo and cool the surface. A key motivation for potential MCB interventions is to prevent the worsening of extreme weather under greenhouse gas warming. In this project, the student will study the impact of MCB on extreme precipitation and temperature events in novel Community Earth System Model 2 (CESM2) and Energy Exascale Earth System Model (E3SM) climate model simulations generated by the UVic Climate Dynamics group and their collaborators. The student will apply widely used extreme event statistics and manage large climate model datasets using Python, with the aim of determining if MCB would indeed be effective for reducing extreme weather. **Location:** BWC, UVic	**401**	May 1, 2023

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SUPERVISOR(S):	PROJECT TITLE AND OUTLINE:	CODE:	START DATE:
Dr. Laurence Coogan Professor, School of Earth and Ocean Sciences lacoogan@uvic.ca	**Tracking the mineralogical evolution of a hydrothermal plume** The project will use sequential extraction techniques to determine the mineralogy of, and mineral compositions in, hydrothermal particles from the Endeavour ridge hydrothermal plume. A range of different reagents will be used to extract different minerals, and a series of tests will be performed to optimise the approach. Extractions will be analysed for major and trace element compositions using the ICP-MS in SEOS. Because of the nature of the work significant experience in chemistry, as well as Earth sciences, is required. **Location** – BWC B415/B423	**4604**	May 1, 2023
Dr. Hansi Singh Assistant Professor, School of Earth and Ocean Sciences **hansingh@uvic.ca**	**Machine Learning for Improved High-Resolution Precipitation Forecasts** Proposal: Forecasting precipitation accurately over the coastal and mountainous regions of British Columbia can be challenging. Weather model output is imperfect and requires post-processing (such as bias correction) especially over complex terrain. An efficient tool to improve model forecasts is data-driven machine learning. This project experiments with data-driven methods of different sophistication to investigate predictive improvements versus computational performance, and sensitivities to the input training dataset. The student will develop valuable skills in machine-learning, data analysis and verification. Experience with Python would be beneficial. **Location:** BWC, UVic	**401**	May 1, 2023
Dr. Victoria Arbour Adjunct Assistant Professor, School of Earth and Ocean Sciences varbour@royalbcmuseum.bc.ca	**Triassic ichthyosaurs from British Columbia** Ichthyosaurs were superficially dolphin-like reptiles that lived during the Mesozoic Era. They are well represented in the Triassic of northeastern British Columbia, but are also known from Haida Gwaii and Vancouver Island. The NSERC USRA student will photograph, illustrate, and describe newly identified ichthyosaur specimens in the Royal BC Museum palaeontology collection, and make preliminary anatomical comparisons using published literature. There may be opportunities to learn vertebrate fossil preparation skills. The student will also learn relevant museum collection skills, including reviewing and updating catalogue records and re-housing other Triassic vertebrates and invertebrates in the collection as needed. The student will have opportunities to share their work with the public either in-person or virtually through the museum's public engagement channels. **Location:** Royal BC Museum	**4000 - 4010**	May 1, 2023

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SUPERVISOR(S):	PROJECT TITLE AND OUTLINE:	CODE:	START DATE:
Dr. Diana Varela Professor, School of Earth and Ocean Sciences dvarela@uvic.ca	**Pelagic primary production and nutrient dynamics in Pacific Arctic and sub-Arctic marine regions.** Phytoplankton play a fundamental role in the cycling of elements in the ocean by taking up dissolved nutrients and returning them back to seawater after death and decomposition. Phytoplankton physiology can therefore affect the carbon balance in the upper water column, which in turn influences atmospheric CO_2 concentrations and modifies global climate. Furthermore, phytoplankton growth and biomass impact the functioning of marine ecosystems because they represent the base of marine food webs. This project will involve the analysis of primary production, phytoplankton biomass and dissolved nutrient concentrations in seawater samples collected from different locations of the North Pacific Ocean, and Bering and Chukchi Seas during oceanographic expeditions from southern Vancouver Island to Barrow (Alaska). The student will be responsible for learning and conducting analytical methods to a high level of proficiency. Additional responsibilities will include assisting graduate students in laboratory projects and preparing for field work. There is a possibility of participating in an oceanographic expedition. If time allows, the student will conduct a comparison of the phytoplankton and nutrient data generated in previous years from the Pacific Arctic and sub-Arctic. Comparisons will allow for the determination of changes in oceanic conditions over long temporal and spatial scales. Results from this work will contribute to our understanding of how phytoplankton (the most important marine primary producers) and nutrients are being affected by climate-driven oceanic changes. This award will expose the student to a variety of techniques in marine biology (e.g. microbiology, analytical chemistry, data analysis) and to interdisciplinary oceanography. Preference will be giving to students with relevant experience. **Location –** BWC B312	**4602**	May 1, 2023
Dr. Jay T Cullen Professor, School of Earth and Ocean Sciences jcullen@uvic.ca	**Research cruise on icebreaker CCGS Sir Wilfrid Laurier to measure surface water chemistry in the northeast Pacific and Arctic Oceans** The student will be responsible for preparing equipment for, loading and participating in an oceanographic research expedition on a Canadian Coast Guard icebreaker to the northeast Pacific and Arctic Oceans. The research assistant will provide support in the laboratory to stage the expedition which is scheduled for July-Aug 2023. The ship departs from Victoria across the northeast Pacific, stops in Dutch Harbor Alaska before working in the Bering Sea and Beaufort Sea in the Canadian Arctic. The student will depart the ship in Barrow Alaska and return to Victoria by air. On the ship the student will be responsible for collecting large volume surface seawater samples and processing them for subsequent chemical analysis and also assist with the collection of samples for determining routine hydrographic/oceanographic parameters. Students with some background in chemistry and an interest in ocean field work are preferred. **Location** – BWC A415	**4600** **4603**	May 1, 2023

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SUPERVISOR(S):	PROJECT TITLE AND OUTLINE:	CODE:	START DATE:
Dr. Andy Fraass Assistant Professor, School of Earth and Ocean Sciences andyfraass@uvic.ca	**The fossil record of the calcareous nannofossils** The fossil record of marine microfossils is of higher quality and resolution than any other fossil record. Fossils are found in relatively continuous deep-sea sections, are readily identified by specialists, and are found in enormous quantities. Occurrence tables at the species levels have been collected for ~50 years as a part of scientific ocean drilling, but these data require checking by humans to identify typos, to reformat the data into a shared format, and other issues. Student would be involved in checking this information, focusing on the calcareous nannofossils, but possible working with other data as well. In addition, student might aid a PhD student in working on the age models for the sediments which contain (or are composed of) these fossils. Student will learn about macroevolutionary and macroecological data and techniques, through R (preferred) or python (if necessary). This work is connected (but not funded by) an international group working on moving all scientific ocean drilling data on microfossils, lithology, and age models into two database systems (Macrostrat and the Paleobiology Database). The research output is likely to be focused on measuring the resolution of the microfossil record. **Location** – University of Victoria, Fraass Lab (preferred) or Virtual	**4011**	May 1, 2023
Dr. Roberta Hamme Professor, School of Earth and Ocean Sciences rhamme@uvic.ca	**Investigating marine productivity rates** Outline of proposed research project (specify student's role): This project would use dissolved gas data collected near Bermuda to investigate marine biological productivity rates. Net photosynthesis in the surface ocean produces dissolved oxygen, but oxygen in the ocean is also affected by physical processes. We have made near-monthly measurements of dissolved O2/Ar ratios in 2019 and 2021 at a station near Bermuda. Argon has similar physical properties to oxygen, so O2/Ar ratios correct for some of the physical impacts on O2, yielding a more purely biological signal. The student would use this data to calculate biological productivity rates using an established mass balance approach. The student would then interpret the patterns they find in productivity rates relative to other seasonal cycles and intermittent events like changes in temperature, mixed layer depth, and storms, as well as comparing to independent datasets like satellite-derived chlorophyll. **Location:** BWC, UVic	**4603**	May 1, 2023