

Dissolution of atmospheric dusts in naturally acidic waters of peat bogs: influence of organic ligands and impacts on trace element speciation

The SWAMP laboratory in the Department of Renewable Resources at the University of Alberta is pleased to offer an opportunity to undertake research at the M.Sc. level

Background

Open pit mining of the Athabasca Bituminous Sands in northern Alberta generates considerable volumes of dust. The dusts are dominated by coarse-grained minerals that are largely insoluble such as quartz, but also fine-grained minerals such as clays and more reactive phases such as carbonates. The dusts contain varying amounts of trace elements (TEs), some of which may be released to surface waters upon deposition from the air. Peat bog waters which are naturally acidic (pH 4), offer a chance to study the extent to which these dusts dissolve in the peatlands that dominate the landscape. In this sense, peat bogs represent natural biomonitoring systems that can be used to understand the chemical reactivity of atmospheric particles. The study will provide new insight into which dust particles are most reactive, as illustrated by the release of TEs. All of the analytical work will be undertaken in the metal-free, ultraclean SWAMP lab.

Focus and scope

Under the direction of the Principal Investigator, Prof. William Shotyk, and the Research Associate, Dr. Fiorella Barraza, the successful candidate will focus on dust dissolution and TE transformations. Experiments will be undertaken using a range of relevant materials, including soils and sediments as well as industrial materials that generate dust in the landscape (tailings, coke, and road building materials). Selected size fractions will be leached using low molecular weight organic acids (LMWOA) such as oxalic acid and citric acid, as well as humic substances. The main goal is to quantify the release of TEs across the spectrum of materials contributing atmospheric dusts. An important secondary goal is to understand the importance of the size of organic molecules, at a fixed pH, on dust dissolution. The analytical techniques to be employed include ICP-MS (Inductively coupled plasma mass spectrometry), AF4-ICPMS (asymmetric flow field flow fractionation coupled to inductively coupled plasma mass spectrometry), ICP-OES (inductively coupled plasma - optical emission spectrometry), SEM (scanning electron microscopy) and XRD (X-ray diffraction).

The successful candidate will interact with a number of support staff, undergraduate and graduate students, and postdoctoral fellows in the lab. Collaboration and reporting to industry partners will also be expected. In addition to writing a thesis, at least one manuscript for journal publication is expected, as well as participation in workshops and national and international conferences. This position has funding for 30 months, starting on August 2024.

Key Qualifications

- B.Sc. degree in Chemistry, Biology, Earth or Environmental Science. Experience with analytical chemistry, geochemistry or soil chemistry an asset.
- Strong English language communication skills (written and oral).
- Strong numerical, statistical and computer skills.
- Proficient with Microsoft Office and relevant Google applications.
- Capable of conducting field work, as necessary, in Northern Alberta.
- Basic knowledge of laboratory safety.
- Experience working in a chemistry laboratory is an asset.
- Ability to engage in complex data analyses and to follow very detailed SOPs
- A teamwork aptitude - ability to work independently but also to help organize research activities with others
- Proactive, flexible, dedicated, well-centered, responsible

Additional Information

University of Alberta is consistently rated as one of the top 5 universities in Canada, and one of the top 100 universities worldwide. Located in Alberta's capital city, Edmonton (population one million), University of Alberta provides a dynamic mixture of a large research-intensive university, urban culture and recreation.

More than 39,000 students from across Canada and 144 other countries participate in nearly 400 programs and 18 Faculties. Within the University, the Department of Renewable Resources consists of 30 faculty members, over 200 graduate students, numerous postdoctoral fellows and support staff, and offers significant research support through sophisticated laboratories and multiple field facilities.

Website Links

<https://swamp.ualberta.ca/>

<https://people.ales.ualberta.ca/williamshotyk/>

<http://www.rr.ualberta.ca>

To Apply:

Please apply by e-mail. Include a cover letter, CV, transcripts (scanned unofficial copy), and contact information for three references to:

Dr. William Shotyk, Professor and Bocock Chair for Agriculture and the Environment, University of Alberta

c/o Dr. Fiorella Barraza

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