Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **435** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

# (G*) Molybdenum stable isotope measurements of petroleum coke in the Athabasca Oil Sands Region

*Monday 7 June 2021 16:20 (5 minutes)*

Molybdenum possesses seven stable isotopes and the relative amounts of these isotopes are found to vary in nature. This is because physical and chemical processes can redistribute the isotopes in a system due to the differences atomic masses. Specific processes can leave an "isotopic fingerprint"that may be recorded in the isotopic composition of the element in a given sample. The interpretation of these data can enable one to elucidate source(s) and processes that may have affected the element. An important example of a potential Mo source is petroleum coke (PC). This is a by-product from the extraction of crude oil from the Oil Sands in northern Alberta and although it is employed as a fuel source, it is not used as quickly as it is produced, allowing it to accumulate on site [1]. There is evidence PC dust spread by wind contributes to an increase in polycyclic aromatic hydrocarbons (PAH) and polycyclic aromatic compounds (PAC) accumulating in lichen samples in forests in the Athabasca Oil Sands Region [2]. This could mean that trace metals are deposited in forests or bodies of water. Natural sources of the surrounding oil sands and bitumen seeps mean that the Athabasca River contains relatively high concentrations of metals compared to glacial counterparts. It is vital to distinguish between the natural and anthropogenic inputs so that appropriate procedures can be put in place to minimize human impacts on the region. Concentration measurements of Mo in aqueous environments provide ambiguous results as they do not necessarily distinguish between natural and industrial sources. Isotope abundance data can provide additional information on the source and history of the material. This project measured the isotopic composition of Mo leached from PC. Isotope determination was done using the double spike method measured with a Neptune multi-collector ICP-MS. The δ97/95 values for three oven dried PC leachate samples were determined to be +0.13 ‰, +0.34 ‰, and +0.81 ‰ with a 2σ uncertainty of 0.06 ‰. These samples had concentrations of 3.16, 9.47, and 0.55 µg/L respectively (uncertainty of 5 %). The isotopic composition of samples from this region gives a better understanding of the sources and sinks of Mo and can be combined with snow, lichens, and water to identify potential environmental concerns caused by PC distributed by wind.

1. J. M. Robertson et al. Aqueous- and solid-phase molybdenum geochemistry of oil sands fluid petroleum coke deposits, Alberta, Canada. Chemosphere 217, (2019).
2. M. S. Landis et al. Source apportionment of an epiphytic lichen biomonitor to elucidate the sources and spatial distribution of polycyclic aromatic hydrocarbons in the Athabasca Oil Sands Region, Alberta, Canada. Science of the Total Environment 654, (2019).

**Author:** KRUSCHEL, Courtney

**Co-author:** WIESER, Michael (University of Calgary)

**Presenter:** KRUSCHEL, Courtney

**Session Classification:** M3-8 Applied Physics (DAPI) / Physique appliquée (DPAI)

**Track Classification:** Applied Physics and Instrumentation / Physique appliquée et de l'instrumentation

(DAPI / DPAI)