Monitoring emissions from the Athabasca Oil Sands using stable isotopes from black spruce (*Picea mariana*)

HEATHER MOSHER* AND ALEXANDER P. WOLFE

University of Alberta, Edmonton T6G 2E3, AB, Canada
(*correspondence: hmosher@ualberta.ca)

Atmospheric deposition in boreal forest ecosystems

The Athabasca Oil Sands industrial complex in northeastern Alberta, Canada, emits tons of CO_2, NO_x and SO_x daily, as well as various trace metals and aromatic hydrocarbons. The effects of these emissions on the surrounding, nutrient-limited, boreal forest ecosystem is not yet fully understood, especially with regards to deposition of bio-available reactive nitrogen (Nr). The possibility exists that industrial nitrogen subsidies may increase forest production, although this has not yet been assessed.

Nitrogen and carbon stable isotope data from year-old black spruce needles (*Picea mariana*) collected around the Athabasca Oil Sands suggest a possible fertilization effect promoting tree growth. Observed depleted nitrogen values correspond well with depleted carbon values regionally. However, the most proximal sites show clear signals that increased deposition may result in tree physiological stress, most likely related to the deposition of trace metals, and thus locally annulling any positive effects of Nr deposition on tree growth. Paired C and N sotopes from wood cellulose generally support needle measurements, together providing a detailed overview of the interactions between atmospheric deposition, nutrient cycling and tree ecophysiological stress.

Initial results from a new time resolved microfocus XEOL facility at the Diamond Light Source

J.F.W. MOSSELMANS[1], R.P TAYLOR[1,2], A.A. FINCH[2] AND P.D. QUINN[1]

[1]Diamond Light Source, Didcot, OX11 0DE, UK
(*correspondence fred.mosselmans@diamond.ac.uk)
[2]Dept. of Earth Sciences, St Andrews, KY16 9AL, UK
(aaf1@st-andrews.ac.uk)

Time Resolved spectrometer

We have constructed a Time-Resolved X-ray Excited Optical Luminescence (TR-XEOL) detection system at the Micofocus Spectroscopy beamline I18 at the Diamond Light Source. TR-XEOL allows the study of short lived states in isolation from long-lived cascade generated signals and thus potentially identify and study transient luminescent centres.

The system uses a Horiba-Jobin Triax Spectrometer and Hamamatsu R3809U-50 microchannel-plate photo multiplier tube. Triggering on the RF clock, we are able to record data in time bins of 6.2 ps in the 230 ns gap between the hybrid bunch photons and those from the main group of electron bunches orbiting the ring. We can detect light over the range 180-850 nm using a bespoke optical fibre, with X-ray excitation energies between 2 and 20 keV.

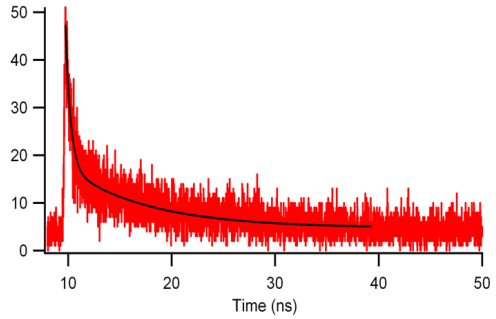

Figure 1: TR_XEOL spectrum from Labradorite Feldspar at 400 nm fitted with 2 exponentials of 1.6 and 29.7 ns.

Initial results

We have examined several different feldspars looking at the short-lived emissions in the UV region. We have observed two exponential decay lifetimes at 400 nm one with a lifetime of 1.6 ns and a second of 29.7 ns from a single crystal labradorite plagioclase feldspar (RT50c, Smithsonian Institute), an untreated single crystal collected from Clear lake Utah USA. In contrast, R1-11a, a microcline cryptoperthite from the Prins Christians Sund granite suite South Greenland [1], showed variable lifetimes at 400 nm, a short lifetime whose mean value was 0.20±0.13 ns and a longer life component of 13.5 ns. The potential of TR-optically detected XAS will be discussed.

[1] Finch & Klein (1999) *Contr. Mineral. Petrol.* **135**, 234–243.