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Sustainability Seminar Series, 2018

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Exploiting Synchrotron “Light” to Study Chemistry of Trace Elements in Soils and Plants

Ryan Tappero

Brookhaven National Laboratory

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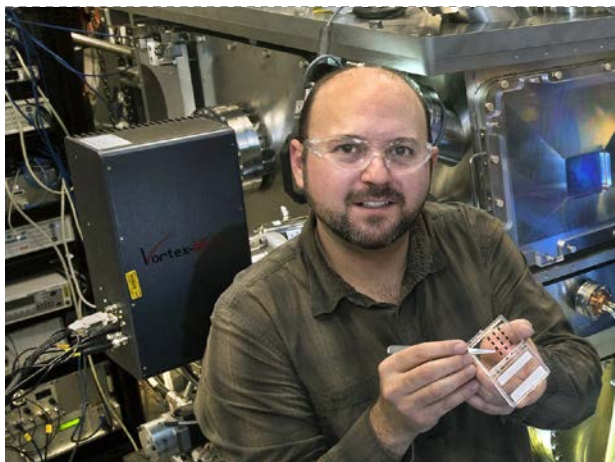


The MSU Sustainability Seminar Series Presents:
**Exploiting synchrotron “light” to study chemistry of
trace elements in soils and plants**

WHEN: April 3, 4:00 pm

WHERE: CELS 120 lecture hall

Dr. Ryan Tappero
Brookhaven National Laboratory



Dr. Ryan Tappero (“Ryan”) is a casual and humble scientist at Brookhaven National Laboratory who does not like to write in the third person. But he does like to apply scientific method to problems in geo-, enviro- and soil sciences. Ryan is a soil chemist by training who holds a position as a beamline scientist at the National Synchrotron Light Source (NSLS-II) where researchers from around the globe visit to use advanced X-ray imaging and spectroscopy tools to study materials ranging from batteries to biological cells. Ryan is also adjunct faculty in the Plant and Soil Sciences Department at the University of Delaware.

Biogeochemical studies often require characterization of elemental abundances and speciation in samples that are chemically and physically heterogeneous at the micrometer scale. Synchrotron radiation sources are ideal for developing high intensity, highly-focused X-ray probes for interrogating the speciation, transport, and reactions of trace elements in heterogeneous earth and biological materials with detection sensitivities in the attogram range and spatial resolutions less than 1 micrometer.

X-ray Fluorescence Microprobe (XFM) is a new, multi-modal X-ray fluorescence microscope recently installed at the National Synchrotron Light Source-II (NSLS-II) at Brookhaven National Laboratory. XFM has capabilities for X-ray micro-fluorescence (μ -XRF) imaging and tomography, X-ray absorption spectroscopy (μ -XAS), and X-ray microdiffraction (μ -XRD). Micro-XRF allows one to image and quantify the distribution of trace elements in heterogeneous samples. Micro-XAS analysis allows one to interrogate oxidation state and chemical speciation of the trace elements. Coupled XRF-, XAS-, XRD- microanalysis allows one to quantify the abundance and speciation of elements at trace concentrations and evaluate the mineralogy to which they are adsorbed or bound in soil. Such information is crucial in understanding the toxicity, mobility and containment of toxic metals in the environment and the mechanisms of nutrient uptake and partitioning in plants. Examples will be given of how these instruments are applied in the Plant and Soil Sciences.