OCGC SEMINAR

Fingerprinting sources and pathways of contaminants in the Athabasca Oil Sands Region.

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Abstract

The real environmental footprint of the Athabasca Oil Sands (AOS) industrial operations has proven contentious because the primary source of both natural and industrial contaminant loading to the local environment are the same (bituminous McMurray Formation). Thus, AOS-industry opponents use high contaminant concentration data from the area of operations as evidence for a high environmental footprint. In contrast, AOS-industry proponents point out that the area of high concentration is coincident with the outcrop of bituminous McMurray Formation oil sand, and thus at least some of the contaminant load is likely natural. AOS environmental regulation uses the abundant monitoring concentration data to define contaminant loadings. However, to date this data has proven inadequate to identify, let alone quantify, what portion is industrial and what is natural. The SOURCES Project of the Environmental Geoscience Program of the Geological Survey of Canada (GSC) has taken a different approach, taking as its working hypothesis that isotopic methods can fingerprint different sources and pathways of contaminant loading, and thus be used as a method for apportioning natural versus industrial loadings. Implicit in the hypothesis is that the industrial activity alters the isotopic signature of some components that can then be used to both fingerprint and quantify the industrial emissions to the local environment. SOURCES research has demonstrated that both inorganic and organic isotopic signatures can successfully fingerprint industrial sources of contamination, and when used in conjunction with concentration data can deliver end-member compositions from which industrial versus natural emissions can be quantified. The isotopic signature deviation relies on diverse processes within the bitumen extraction system that cause divergence from the natural background signature; eg. high temperatures during processing (H_20 isotopes; Li isotopes; napthanic acid C isotopes); addition of components during processing (S isotopes; Pb isotopes). The pathways and budgets of industrial emissions is the current focus of research. Waterborne pathways in particular have proven more difficult, primarily due to a lack of well characterized sites on which to test flux and apportionment methods. Using a recently defined tailings pond leak, SOURCES is building a reactive transport model to better understand both the fluxes and the geochemical evolution of the plume.

Dr. Paul Gammon *graduated from James Cook University (Australia), followed by postdoctoral fellowships at Queen's University, Kingston and Adelaide University, South Australia. Paul now leads the Geological Survey of Canada's environmental geochemistry laboratories. Paul's research focusses on the relationships between and isotopic geochemistry, hydrology and sedimentology.*

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