Hutchison Medal Lecture Tour 2019-2020: Brian Kendall

Talk #1: Tracking the rise and fall of oceanic O_2 levels on the Precambrian Earth using the redox-sensitive trace metal geochemistry of sedimentary rocks

Accurate estimates of atmosphere-ocean redox conditions through time are necessary to address grand challenges such as explaining the time lag of several hundred million years between the evolution of oxygenic photosynthesis and the early Paleoproterozoic Great Oxidation Event, as well as constraining the relative importance of environmental versus genetic barriers as controlling factors behind the late initial animal diversifications in the Ediacaran and Cambrian. Traditionally, efforts to infer Precambrian ocean redox conditions at ocean-basin to global scales have been hampered by the need to make such inferences from marine sedimentary rocks preserved in continental margin environments because open-ocean abyssal seafloor has been lost to subduction. Recently, new insights on Precambrian ocean redox conditions at these larger spatial scales have been provided using the concentration and isotopic composition of non-traditional redox-sensitive trace metals (e.g., molybdenum, uranium, rhenium, osmium, thallium) in black shales, carbonates, and iron formations. Despite the fragmentary nature of the Precambrian rock record, the redox-sensitive metal geochemical data from sedimentary rocks point to a complex history of rising and falling environmental O_2 levels, including transient oxygenation events in the Archean and middle Proterozoic. The redox instability on the Proterozoic Earth likely contributed, at least partially, to the nearly ~2 billion-year delay in initial animal diversification after the Great Oxidation Event.

<u>Hutchison Medal Lecture Tour 2019-2020: Brian Kendall Biography</u>

Dr. Brian Kendall uses the concentration and isotopic composition of redox-sensitive metals in sedimentary rocks to reconstruct changes in atmosphere-ocean redox conditions and seawater chemistry through time and infer their impacts on biological evolution and mass extinction. This effort initially focused on the rhenium-osmium geochronology of Precambrian black shales, leading to MSc and PhD degrees from the University of Alberta in 2003 and 2008, respectively. Subsequently, Dr. Kendall held a two-year Agouron Institute Geobiology Postdoctoral Fellowship at Arizona State University where he expanded his research program to include non-traditional metal isotope systems, particularly molybdenum and uranium. After four years at Arizona State University, Dr. Kendall moved to the Department of Earth and Environmental Sciences at the University of Waterloo in 2012 to begin a faculty position and establish a new metal isotope geochemistry laboratory. Dr. Kendall teaches undergraduate courses in introductory geochemistry, petrography and igneous petrology, as well as graduate courses in radioactive/radiogenic isotope geochemistry and metal stable isotope geochemistry. A Tier II Canada Research Chair in redox-sensitive metal isotope geochemistry was awarded to Dr. Kendall and will begin September 2019.