NOVEL ISOTOPIC METHODS FOR ASSESSING ENVIRONMENTAL CONTROLS ON EARLY JURASSIC SOURCE ROCK DEPOSITION IN WESTERN CANADA AND IDENTIFYING THE SOURCES OF THE HYDROCARBONS OF THE ALBERTA TAR SANDS

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The causes and consequences of the Toarcian Oceanic Anoxic Event (183 m.y.a.) and its regional versus global effects are heavily debated. On a first order, many of stratigraphic successions encompassing this interval are marked by the onset of organic-rich black shale deposition with total organic carbon contents in some successions ranging up to 30 weight percent. One model for the increase in organic carbon deposition associated with the Toarcian involves the expansion of water column anoxia from nutrient loading and subsequent biological productivity. The enhanced flux of nutrient-rich riverine water stimulates large algal blooms in the modern ocean, and is generally related to seasonal changes related to monsoons and melting snowpacks. Osmium isotopes ($^{187}Os/^{188}Os$) will be measured from organic-rich mud rocks as a proxy to track past changes in the contribution of continental materials to the oceans, and will test the models for the generation of increased biological productivity and subsequent marine anoxia and source rock deposition across the Toarcian. If global weathering rates increased during this event, then more radiogenic (higher) $^{187}Os/^{188}Os$ values are expected during the event. Additionally, rhenium isotopes will be measured in order to assess the contribution of Toarcian source rocks to the Alberta tar sands. At the moment, this major hydrocarbon deposit is thought be sourced by the Mississippian Exshaw Formation, the Jurassic Fernie Formation, or both. Finally, the rhenium and osmium geochronometric technique will also be utilized to develop the first robust radiometric date of the Toarcian Oceanic Anoxic Event.

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