Precipitation isotopes and paleoclimates from the frozen Eastern Beringian underworld

Precipitation-derived stable isotope ratios of hydrogen (δD) and oxygen (δ18O) from ice layers in ice cores are widely recognised as a gold standard temperature proxy in paleoclimate studies, and have revealed more about Late Quaternary climate extremes than perhaps any other land-based proxy. However, long ice core records are mostly restricted to ice cap locales, which leaves large spatial gaps in knowledge of precipitation isotopes and climate in the pan-Arctic. In this talk, I will discuss recent efforts to close gaps in the paleo-water isoscape by employing an unconventional water isotope archive – relict ice in syngenetic permafrost. Syngenetic permafrost is permafrost that forms simultaneously with an aggrading surface. In rapidly aggrading systems, syngenetic permafrost has great potential to stratigraphically preserve ancient meteoric waters as sediment pore ice. This talk demonstrates this potential using long records of pore ice δD and δ18O from two different types of aggrading systems in central Yukon, Eastern Beringia: (1) a soligenic peatland near Engineer Creek on the Dempster Highway which aggraded continuously over the last ~13 ka; and (2) a composite record of valley-loess deposits from the Klondike Goldfields spanning the last ~50 ka. Critical attention is paid to uncertainties regarding the formation of these deposits, which has a major influence over the seasonality of precipitation integrated and preserved as ground ice and, consequently, the paleoclimate signal. Long-term isotope trends documented in these records are correlated to traditional ice core records from Mt. Logan (S.W. Yukon) and Greenland to evaluate the regional and hemispheric coherence of the precipitation isotope trends, and attributed to changing boundary conditions and local climate. Last, this talk aims to shift traditional notions about permafrost from simply being a subterranean thermal state, to a viable proxy archive with untapped potential to advance current understanding of the Arctic system.

Prof. Trevor Porter is an Assistant Professor at Dept. of Geography at UTM. His research focuses on northern paleoenvironmental change over recent centuries to millions of years BP. He specializes in reconstructing the past from natural proxies such as tree-rings, leaf waxes, ice-rich permafrost, and the stable isotopes they contain. Most of this work is based in northwest Canada and Alaska. Visit this website for more information: https://tjporter.wordpress.com/