Abstract ID : **89**

New application of noble gas ratios to generate Arctic melt records

Content

Surface melt on ice sheets occurs during summer, meaning that melt frequency and intensity are useful proxies for summer temperatures—specifically, the number of days above freezing (so-called positive-degree days). Melt layers in ice cores are typically identified visually, but this method can be prone to errors and is impossible to apply in clathrate ice and ice that has been heavily thinned by ice flow. The heavy noble gases xenon (Xe) and krypton (Kr) are more soluble in water than lighter gases argon (Ar) and nitrogen (N₂), causing them to become enriched in melt layers.

Using the isotopic and elemental ratios of these heavier to lighter gases, this project aims to generate melt records of key warm periods in four Arctic ice cores (RECAP, NEEM, GISP2, and Mt. Hunter). While this method has been used previously to identify melt events in the Eemian section of the NEEM ice core, this will be the first systematic application of the noble gas ratio method to obtain data on past melting.

We present a new analytical setup that is being developed at Oregon State University to perform these analyses. This line will be able to melt four samples at a time and extract the gases from within the ice, employing several traps to condense or react out undesired gases before storing samples in a cryostat. Analysis will be conducted on a MAT 253 Plus mass spectrometer using a peak jumping method to obtain elemental and isotopic ratios of Xe, Kr, Ar, and N₂.

These records will be applied to answer four primary research questions: 1) What are the long-term drivers of Arctic melt? 2) What were the timing and magnitude of the Holocene Thermal Maximum in Greenland? 3) What was the extent of melting during the Last Interglacial? 4) How do current melt rates in the Arctic compare to the last 10,000 years? The answers to these questions will increase our understanding of how forcings affect the Arctic cryosphere system, including Arctic resilience in the face of anthropogenic climate change. Noble gas melt analyses of Eemian ice samples from GISP2 and Renland are planned for the summer of 2022 at the Scripps Institution of Oceanography using a previously established setup.

Primary authors: Ms WILLIAMS, Olivia (Oregon State University); Dr BUIZERT, Christo (Oregon State University); Dr SEVERINGHAUS, Jeff (University of California, San Diego, Scripps Institution of O ceanography); Dr BROOK, Edward (Oregon State University)

Presenter: Ms WILLIAMS, Olivia (Oregon State University)

Track Classi ication: Progress in proxy development and interpretation