

A proof of concept using THE FUSIONS 970 DIODE LASER STEPPED HEATING SYSTEM:
Extraterrestrial ^3He as a proxy for fresh water volume released during Heinrich Events

Gisela Winckler and Sidney Hemming

Lamont-Doherty Earth Observatory, Columbia University

Abstract

Among the most spectacular examples of abrupt climate changes are Heinrich Events, abrupt and brief pulses of iceberg discharge across the entire North Atlantic, which severely disrupted the Earth climate system and may have considerably affected global sea level. However, direct evaluation of the magnitude of fresh water released during Heinrich events as well as the mechanisms that drive the events remain a matter of debate.

Here we propose a proof of concept of the utility of extraterrestrial ^3He , delivered to the earth's surface by interplanetary dust particles (IDPs), to estimate the volume of the fresh water released into the North Atlantic during Heinrich events. Ice sheets accumulate IDPs at a known and constant rate and, thus, the extraterrestrial ^3He excess in Heinrich Event sediments from ocean cores can be translated into the volume of fresh water released during a particular event. Although we know this to be true, the quantification of the extraterrestrial He is not possible with current methods because the signal is swamped by the very large terrestrial ^3He content of these layers. Thus analysis in this type of sediments requires a new technique, laser stepped-wise heating, which is not yet available at Lamont. We are requesting partial support for a diode laser stepped heating system, to be purchased by co-PI Sidney Hemming primarily for her Ar-Ar system, which will give us the unique opportunity to do this kind of analysis to constrain ice volume at Heinrich Events. In addition to this specific application, we anticipate that there will be many climate-relevant applications for this new system on the existing multi-purpose noble gas mass spec as well as the newest addition to our noble gas lab facility, a multi collector system which we expect to install within the next 12 months. This proposal is linked to another proposal submitted by Hemming, Barbeau and Oliver that would apply this system to better constrain the Cretaceous Antarctic glaciation history.