Durham University
Department of Earth Sciences

Prof. James Baldini: james.baldini@durham.ac.uk
Prof. Colin Macpherson (University of Durham)

RECONSTRUCTING ATLANTIC MERIDIONAL OVERTURNING CIRCULATION (AMOC) STRENGTH USING A HIGH-RESOLUTION STALAGMITE $\delta^{18}O$ RECORD FROM LEAMINGTON CAVE

1. Background

Several papers in the past few years have attempted to reconstruct the strength of the Atlantic Meridional Overturning Circulation (AMOC) with different results [1,2] . There is a broad consensus that AMOC strength has been reduced as a result of anthropogenic climate change, but the exact timing of the weakening is controversial. However, constraining the timing of the weakening is critical for assessing what the drivers are, and what the future may hold. The Gulf Stream is a component of AMOC, and its failure would have considerable climate repercussions for northern Europe. T**he aim of this project is to interpret an already generated stalagmite oxygen isotope record from Leamington Cave, Bermuda.** The record extends back approximately 700 years and covers the interval when AMOC is thought to have started weakening. Most importantly, Bermuda is positioned in the middle of the Gulf Stream and is therefore ideally suited for reconstructing AMOC strength.

2. Aims and methods

The aim of this project is to interpret already existing monthly-scale stalagmite records. Specifically:

- Refine the age model (currently radiocarbon with laminae count);
- Plot the geochemical records against the refined age model;
- Interpret the $\delta^{18}O$ record
- Interpret the trace element records, specifically Mg/Ca
- Use the absolutely dated geochemical climate proxy records to assess when AMOC began weakening

3. Scientific approach

This project will use several geochemical datasets to produce an iconic record of both local conditions on Bermuda and AMOC strength over the last 700 years. It is also possible that the

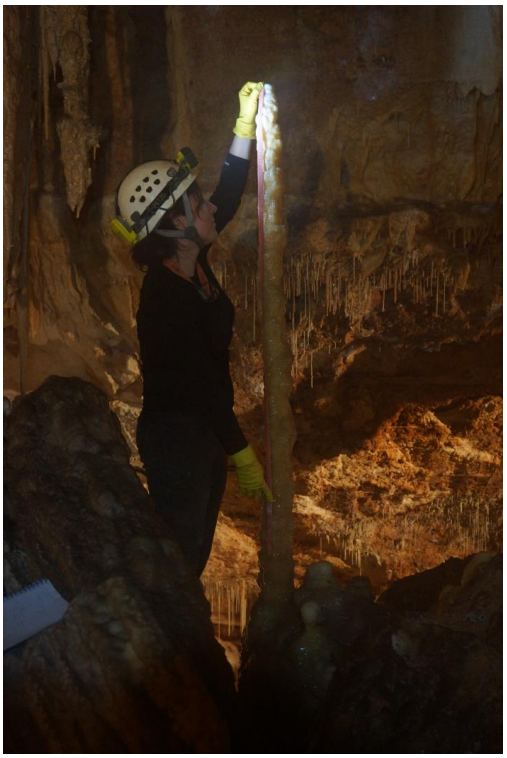

Fig 1. Selecting stalagmites in Leamington Cave. The stalagmite data for this study has already been generated.

$\delta^{18}O$ record will yield information regarding hurricane activity[3], and this is an angle that could be pursued. The records developed will be compared with other records from the North Atlantic and globally to determine the drivers and timing of AMOC slowdown. It is expected that the $\delta^{18}O$ record will reflect local temperature, and by inference, AMOC strength.

4. Training

As a PhD student in the Durham Earth Sciences Department you will become part of a vibrant research culture in which ~70 postgraduate students work on a wide range of Earth Science research projects. In particular, you will closely collaborate with the academic staff, postdoctoral researchers and fellows, and postgraduate students in your research group. Training will be provided on time-series analysis, statistics, and

scientific writing, and you will learn how to analyse and interpret palaeoclimate datasets.

5. Further reading & information

For further information contact: Prof. James Baldini, Dept of Earth Sciences, University of Durham, tel. no 0191 334 2334. james.baldini@durham.ac.uk

1 Thornalley, D. J. R. *et al.* Anomalously weak Labrador Sea convection and Atlantic overturning during the past 150 years. *Nature* **556**, 227-230, (2018).

2 Caesar, L., Rahmstorf, S., Robinson, A., Feulner, G. & Saba, V. Observed fingerprint of a weakening Atlantic Ocean overturning circulation. *Nature* **556**, 191-+, (2018).

3 Baldini, L. M. *et al.* Persistent northward North Atlantic tropical cyclone track migration over the past five centuries. *Scientific Reports* **6**, (2016).