

PROJECT TITLE: Living at the edge: evolutionary trends in foraminifera

DTP Research Theme(s): Living World, Changing Planet

Lead Institution: University of Bristol

Lead Supervisor: **Laura Cotton, University of Bristol, School of Earth Sciences**

Co-Supervisor: Daniela Schmidt, University of Bristol, School of Earth Sciences

Co-Supervisor: Kate Littler, University of Exeter, Camborne School of Mines

Co-Supervisor: David Evans, Goethe-Universität Frankfurt am Main, Institute of Geosciences

Project Enquiries: laura.cotton@bristol.ac.uk

Project keywords: Geology; Ocean; Palaeontology; Evolution; Geochemistry; Eocene; Climate change; morphology; fieldwork;



Image Caption: The Tanzania Drilling Project recovering cores near Kilwa, SE Tanzania

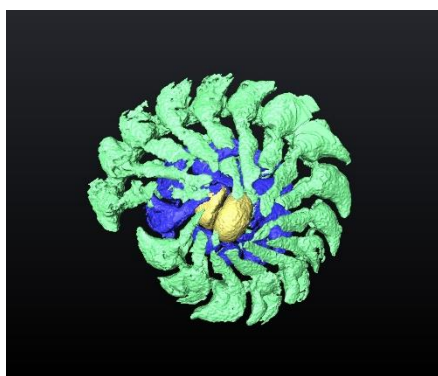


Image Caption: Micro-CT scanned larger foraminifera (2 mm diameter), showing internal chamber space.

Project Background

The Eocene was a dynamic period of Earth's climate, culminating with the onset of the first continental Antarctic glaciation. Morphology of organisms is often thought to be closely linked to environment, but to what extent did the shifting Eocene climate influence morphological and evolutionary trends? Is the response to environmental change the same when organisms are pushed to the limit of their range versus the core of their distribution? Larger foraminifera are single celled organisms which can reach up to 15cm in size. They harbour symbionts, and therefore live in the photic zone of shallow marine, oligotrophic, tropical environments and are highly sensitive to environmental change. In this project, we will couple morphological data from the larger foraminifera with geochemical data from the same record to examine the influence of climate on evolution.

Project Aims and Methods

The overarching aim is to test the relationship between morphological variability and dynamic climate change, both at the edge and in the optimum of an organism's latitudinal range. The interdisciplinary nature of the project will expose you to a wide range of techniques and scientific communities. During the project, you will learn to apply novel isotope geochemistry, micro-CT scanning as well as fieldwork and geometric morphometrics. You will generate two exceptional records of the shallow marine environment. One from the south of the UK, via your own fieldwork and collections of the Natural History Museum, London and the other from Tanzania using material recovered by the Tanzania Drilling Project, which is well known for its exceptional preservation of calcareous microfossils.

There is ample opportunity within the project for you to develop the research following your own interests and strengths, with the possibility of using a variety of methods for collecting fossil data (e.g. micro-CT, thin sections, morphometrics, fieldwork) and climate data (e.g. stable isotopes, trace element geochemistry, parallel records of other organisms) to investigate the influence of climate on evolution.

You will be working within the Micropalaeontology group at the University of Bristol under the supervision of Dr Cotton and Prof Schmidt. Facilities for micropalaeontological preparation, imaging and CT-scanning are all available. You will spend time in both Frankfurt and Exeter with your other supervisors being trained in and collecting geochemical data, as well as collecting your own samples from the south coast of the UK and Isle of Wight.

Candidate Requirements

The ideal candidate for this project would have a background in geology, Earth Science, palaeontology, geochemistry or biology at MSci/MSci/MSc level. With a broad interest in palaeontology and evolution.

Training

During the project the student would be trained in: identification and taxonomy of larger foraminifera, biostratigraphy, micro-CT scanning, Avizo software, thin section and other micropalaeontological preparation, imaging, SEM examination of foraminiferal preservation, field collection (University of Bristol), generation of trace element (Exeter) and stable isotope data (Exeter and Frankfurt), as well as integration and analysis of results. More broadly, the student will receive training on academic writing and presenting.

References / Background reading list:

Cotton, L.J. and Pearson, P.N., 2011. Extinction of larger benthic foraminifera at the Eocene/Oligocene boundary. *Palaeogeography, Palaeoclimatology, Palaeoecology* 311, 281–296.

Evans, D., Sahoo, N., Renema, W., Cotton, L. J., Muller, W., Todd, J. A., Saraswati, P., Stassen, P., Ziegler, M., Pearson, P. N., Valdes, P. and Affek, H. 2018. Moderate tropical warmth in the Eocene greenhouse from coupled Mg/Ca-clumped isotopes. *Proceedings of the National Academy of Sciences* 115, 1174–1179.

Renema, W. and Cotton, L. J. 2015. Three dimensional reconstructions of *Nummulites* tests reveal complex chamber shapes. *PeerJ* 3, e1072.

Links:

School URL

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The application deadline is 1600 hours GMT Monday 6 January 2020 and interviews will take place between 10 and 21 February 2020

General Enquiries:

Bristol NERC GW4+ DTP Administrator

Email: bristol-nercgw4plusdtp-admin@bristol.ac.uk