

PROJECT TITLE: Impact of climate change on marine plankton – lessons from a hot planet

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

Lead Institution: University of Bristol

Lead Supervisor: Daniela Schmidt, University of Bristol, School of Earth Sciences

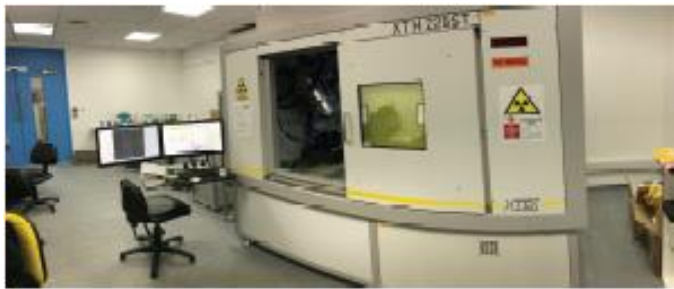
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Co-Supervisor: Kate Littler, University of Exeter, Camborne School of Mines

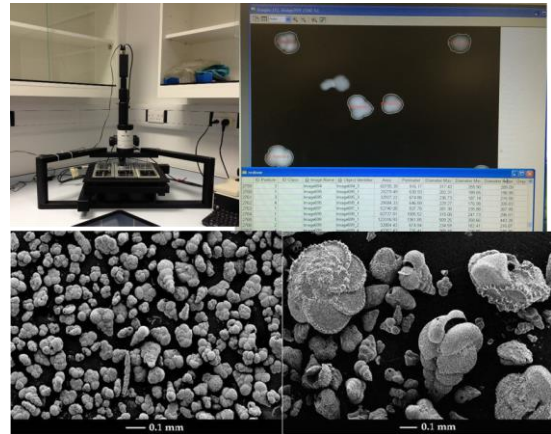
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Project keywords: foraminifers, evolution, paleoceanography, climate change



CT scanner at Bristol university to reveal the development of foraminifers



Automated microscopy and image recognition to analyse morphological change in foraminifers in thousands of samples

Project Background

In 2014 the IPCC stated that “natural global climate change at rates slower than current anthropogenic climate change caused significant ecosystem shifts and species extinctions during the past millions of years”. There is growing concern what impact this rapid climate change has on marine ecosystems and the services these provide. The geological record of climate change events of differing rates and amplitudes may allow us to constrain tipping points within the Earth system.

Here we set out to assess whether the amplitude and rate of climate change scale linearly with ecosystem response, or whether there is a tipping point beyond which marine plankton, specifically foraminifers, cannot deal with the impact of warming by migration and changes in their abundance and size. Planktic foraminifera have an amazing fossil record of more than 100 million years which allows us to quantify the impact of climate change on this group through major perturbations in Earth History.

Project Aims and Methods

The aim of the project is to determine the biotic response to a number of environmental perturbations in the geological record. This project will use the morphology of planktic foraminifers, with a focus on size, as a master trait to assess the impact of climate change on the group. Size in planktic foraminifers indicates optimum environmental conditions. The lab has two automated microscopes which can analyse 2000 specimens in 5 minutes, thereby allowing many events to be assessed.

The student will, jointly with the supervisors and case partner, identify the most promising events and generate size records across for example the Cretaceous-Paleogene boundary, the Palaeocene Eocene boundary, the Eocene hyperthermals. Changes in the ocean physical system will be analysed using trace elements in the foraminiferal shells in Cardiff. Important species/lineages will be morphometrically analysed to address the question at both the species level and the macroevolution/ecology of the group in discussion with the supervisor and the case partner. For critical intervals and species, the underlying link between changes in size and development of the species will be analysed using our in-house CT scanning facilities.

Candidate Requirements

The candidate will have a degree in Geology, Biology or a related subject. The candidate will be curious, organised and self-motivated to take charge of the sample ordering, preparation and analysis of morphological and geochemical data. The candidate will be confident in handling large datasets which will be generated by the automated microscope and the generation of age models.

CASE or Collaborative Partner

The student will get biostratigraphic training including the use of specialist industry standard software. They will be taken through the various aspects of the business, as well as day to day running. This will give them an appreciation of the industry and how it differs from academic work.

Training

The student will join the world leading Bristol Palaeobiology group and be a member of outstanding research environments in all three host institutions. The student will get first-class in-house training in automated image analysis, morphometrics, generation of age models, geochemistry, CT scanning, 3D reconstructions taxonomy and stratigraphy of foraminifers. Additional courses in R, statistic etc are offered by the group and the university. No previous knowledge in taxonomy or geochemistry is expected as all the training will be provided. The Cabot Institute for the Environment provides training in Science communication and the applicant will be encouraged to participate in outreach activities.

References / Background reading list

Jennions, S.M., Thomas, E., Schmidt, D.N., Lunt, D. and Ridgwell, A. (2015) Changes in benthic ecosystems and ocean circulation in the Southeast Atlantic across Eocene Thermal Maximum 2. *Paleoceanography* 30, 1059-1077.

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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:

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