

PROJECT TITLE: Uncovering the long term sensitivity of Southern Ocean phytoplankton to Antarctic climate change, using novel geochemical and ancient DNA proxies

DTP Research Theme(s): Dynamic Earth, Changing Planet

Lead Institution: University of Exeter

Lead Supervisor: (Dr Sev Kender, University of Exeter, Camborne School of Mines)

Co-Supervisor: (Prof Ian Barnes/Dr Selina Brace, Natural History Museum, London)

Co-Supervisor: (Prof Melanie Leng, British Geological Survey, Keyworth)

Co-Supervisor: (Dr Claire Allen, British Antarctic Survey, Cambridge)

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Project keywords: (Southern Ocean; Antarctic Peninsula; Palaeoclimate; Geochemistry; Micropalaeontology)



Iceberg offshore Rothera Research Station, December 2018



Sediment core collection from the RRS James Clark Ross ship, December 2018

Project Background

The Antarctic is changing. Delicate ecosystems, from marine mammals and birds, to the phytoplankton at the base of the food web, are under threat from both global warming and human activities such as fishing and whaling. The goal of this project is to better understand how Antarctic phytoplankton will react and adapt to future changes, by examining changes in the past. The early Holocene is characterised by warming comparable to future 21st century projections, and the Holocene/Anthropocene transition experienced severe environmental disturbance from climate change and fishing during the acceleration of industrialisation. However, there are no fossil records from many of the main phytoplankton groups with which to examine their past sensitivity. In this project the student will reconstruct past phytoplankton changes in the Southern Ocean, and the offshore Antarctic Peninsula, with diatom micropalaeontology and sedimentary ancient DNA – a new technique recently developed for non-fossilising groups. The student will also use geochemistry to date the core material, and reconstruct environmental change.

Project Aims and Methods

The aims of this project are to provide the first records of past changes to Antarctic phytoplankton from species that do not produce a fossil record. Palaeo-proxies for stable isotopes and micropalaeontology will aid in constraining our reconstructions of past environments, with which to build a new understanding of the main causes of phytoplankton change both in the past and into the future.

The student will have opportunities to be involved in the design of the project, particularly with respect to the existing skills and interest in marine, earth and biological sciences. A range of palaeo-proxies are available including but not limited to ancient DNA, isotope geochemistry, and micropalaeontology.

Candidate requirements

The candidate must have a 1st or Upper 2nd class degree in either Earth or Biological Sciences, and the project can be taken in different directions depending on expertise and interest.

Collaborative partner

For this project the British Geological Survey will act as a collaborative partner, providing opportunities for laboratory work experience and additional funding for travel.

Training

The student will have access to a wide range of training made available for at least 3 months of the project via the GW4+ Doctoral Training Partnership. The student will also receive specialist training in sedimentary ancient DNA extraction, analysis, and interpretation. The student will have the chance to gain experience in geochemical and micropalaeontological techniques, and will be supported to apply for Antarctic ship-based fieldwork experience if interested. Experience presenting at national and international conferences will be provided.

Background reading and references

Coolen, M.J.L. *et al.* 2013. Evolution of the plankton paleome in the Black Sea from the Deglacial to Anthropocene. *P. Nat. Acad. Sci. U.S.A.* 110, 8609–8614.

Deppeler, S.L. & Davidson, A.T. 2017. Southern Ocean phytoplankton in a changing climate. *Front. Mar. Sci.* 4, 40.

Pike, J. *et al.* 2013. Glacial discharge along the west Antarctic Peninsula during the Holocene. *Nat. Geosci.* 6, 199–202.

Useful links

For information relating to the research project please contact the lead Supervisor Sev Kender via s.kender@exeter.ac.uk (<http://emps.exeter.ac.uk/csm/research/globalchange/glacial-holoceneantarcticchange/>).

Prospective applicants: For information about the application process please contact the Admissions team via pgrenquiries@exeter.ac.uk.

Each research studentship project advertisement has an 'Apply Now' button linking to an application portal. Please note that applications received via other routes including a standard programme application route will not be considered for the studentship funding.

How to Apply

The application deadline is Friday 8 January 2021 at 2359 GMT. Interviews will take place from 8th to 19th February 2021. For more information about the NERC GW4+ Doctoral Training Partnership please visit <https://www.nercgw4plus.ac.uk>.