PROJECT TITLE: Unravelling the sources of carbon during global warming events

DTP Research Theme(s): Changing Planet

Lead Institution: University of Bristol, Bristol

Main Supervisor: Professor Laura Robinson, School of Earth Science

Co-Supervisor: Professor Paul Valdes, School of Geographical Sciences

Co-Supervisor: CASE partner Dr Diana Sahy / Dr Dan Condon, British Geological Survey

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Project Background

The unprecedented rise in greenhouse gases over recent decades has sparked a field of research examining the links between carbon and climate in warming climates. The last glacial termination (~18-10 ka) witnessed rapid and significant increases in atmospheric carbon dioxide, methane and temperature as well as major changes in ocean circulation, ice volume and global nutrient cycling. As such this deglaciation presents a unique opportunity to examine the links between the carbon cycle and global climate on timescales relevant to the modern day. Competing hypotheses for the sources of carbon during the deglaciation include release of respired carbon from the deep ocean, outgassing of volcanic carbon, release of methane clathrates from marine sediments as well as terrestrial sources such as permafrost melting or low latitude wetlands. Quantifying the role of each of these sources would make a distinct step forward in understanding the links between the terrestrial biosphere, oceans and climate in a changing world.

Project Aims and Methods

The project will combine data and modelling approaches to provide new insights into the intriguing debate around the mechanisms controlling the massive climate disruption of the last deglaciation. The project will focus on radiocarbon as a key tracer of carbon in the Earth system. The decay rate of radiocarbon lends itself to establishing carbon sources and fluxes. Initial analyses will seek to reconstruct the (radio)carbon isotopic composition of the dissolved inorganic carbon in the ocean over the last 20,000 years on a precise timescale providing a baseline that is expected to reflect the interplay between ocean mixing rates, accumulation of respired carbon and air-sea gas exchange. These data will be produced using uranium-series dating and radiocarbon analyses on deep sea corals. Complementary analyses on sediments and authigenic carbon close to sites where methane or geologic carbon may be released from the seafloor to the ocean will be used to examine the potential for additional sources of carbon to influence the ocean-atmosphere carbon budget. The data will be pulled together using modelling approaches to consider the global climate system during the deglacial, testing hypotheses that seek to explain the links between temperature, carbon dioxide and methane in a warming world.
Candidate
The ideal candidate should be interested in the evolution of the Earth system, and paleoclimate in particular. The project will require laboratory analyses as well as a modelling component, so the student should have an aptitude for practical, analytical and theoretical thinking. Field work opportunities may be possible e.g. research cruise.

Case Award Description
The project is a CASE award associated with the British Geological Survey (BGS). The student will primarily be based in Bristol, with regular research visits to BGS in Nottingham to build on the aspects of the project relating to modern and past methane release from the ocean and further development of dating techniques.

Training
This project has excellent training opportunities including laboratory work, field work and carbon cycle modelling. Hands on laboratory skills (clean lab and mass spectrometry) will be gained through one on one training in the Bristol Isotope Group, British Geological Survey and Bristol Radiocarbon Accelerator Mass spectrometry facility. The student will attend DTP and external climate modelling courses, allowing them to develop their quantitative skills throughout the course of the project. Additional DTP training courses and external opportunities (e.g. Urbino Sumer School in Paleoclimatology) will be identified to fulfil knowledge gaps and complement the training portfolio.

References / Reading List


Links
School webpage: http://www.bristol.ac.uk/earthsciences/courses/postgraduate/
https://bristoloceans.wordpress.com/
http://www.bristol.ac.uk/geography/research/bridge/

NERC GW4+ DTP Website: http://nercgw4plus.ac.uk/
Bristol NERC GW4+ DTP Prospectus:
http://www.bristol.ac.uk/study/postgraduate/2017/doctoral/phd-great-western-four-dtp/

Application deadline: 23.59 GMT, Sunday 7 January 2018
How to apply to the University of Bristol:
http://www.bristol.ac.uk/study/postgraduate/apply/

General Enquiries:
Bristol NERC GW4+ DTP Administrator
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