Llamado para postular a Becas Chile 2022

Proyecto de colaboración internacional NERC (UK-Chile)

Descifrando el genotipo de foraminíferos planctónicos del ecosistema de Humboldt: Desafío para la calibración de *proxys* paleoceanográficos

Plazo para mostrar interés: 4 de abril de 2022, 12:00 CLT

¿Eres un amante de las ciencias marinas?

¿Te gustaría participar activamente con un grupo formado por un casi 90% investigadoras?

¿Te gustaría participar por dos años en terrenos en Chile y vivir en la hermosa ciudad de Stirling en Escocia?

Te gustaría ser doctorante de nuestro proyecto de colaboración internacional que busca descifrar por primera vez la genética de foraminíferos planctónicos frente a Chile Norte y Central? ¿Junto con participar en la calibración de proxy como isotopos estables y elementos trazas en foraminíferos planctónicos?

Buscamos estudiantes que estén terminando su tesis de pregrado o magister que estén interesados en la biología molecular y la paleoceanografía **que tengan interés en postular al nuevo llamado de Becas Chile 2022**, para cursar estudios de doctorado en la Universidad de Stirling en Escocia y que quieran formar parte de nuestro reciente proyecto de colaboración internacional NERC (UK-Chile).

El cambio climático actual avanza y estamos en un momento decisivo para afrontar como humanidad como cambiar y cómo nos relacionamos con la naturaleza. Para modelar escenarios climáticos futuros, es importante comprender cómo ha cambiado el clima y condiciones oceánicas regionales/globales en el pasado. Para estudiar como fue el océano en el pasado usamos herramientas llamadas proxies para estudiar cómo fueron distintas variables hidrológicas, como la temperatura, la densidad, el contenido de nutrientes, la oxigenación de la columna de agua, entre otros. Muchos de estos proxies están basados en el análisis de la conchilla de pequeños organismos llamados foraminíferos. Estas conchillas se preservan en el registro fósil y pueden ser usadas para reconstruir las condiciones oceánicas y climáticas del pasado.

Uno de los grandes problemas en el estudio de proxies basados en foraminíferos es que todavía no logramos saber en zonas de afloramiento costero y en zonas de bajo oxigeno como en Perú/Chile si los genotipos se condicen con los morfotipos específicos de estos organismos. Desde 2017, nuestro de investigación y colaboradores nos hemos enfocado a la calibración geoquímica de estos organismos, acoplando la caracterización genética con análisis morfológicos basados en atributos de la conchilla.

Estamos en búsqueda de apoyar estudiantes en postular al llamado de Becas Chile 2022 para poder realizar su doctorado bajo el alero del proyecto de colaboración internacional NERC (UK-Chile). El proyecto complementará los recursos de becas Chile, financiando movilidad internacional, la participación en congresos científicos, análisis de muestras y terrenos en Chile.

Requisitos para postular:

- Leer de forma detallada las bases de Becas Chile https://www.anid.cl/concursos/concurso/?id=921
- Ser de nacionalidad chilena o con permanencia (extranjeros) definitiva en Chile.
- Poseer (el certificado al día) el grado académico de Licenciado(a) (cuando se trate de carreras cuya duración mínima es de ocho semestres); Título Profesional (cuando se trate de carreras cuya duración mínima sea de diez semestres) o acreditar estudios de pregrado equivalentes, en el caso de estudios realizados en el extranjero.
- Poseer excelencia académica acreditando (certificado al día) al menos, **uno** de los dos siguientes requisitos: Haber obtenido un promedio de notas de licenciatura, título profesional o equivalente igual o superior a cinco (5.0) sobre un máximo de siete (7.0) o su equivalente en relación con la escala de 1 a 7; o bien

encontrarse dentro del 30% superior del ranking de egreso de pregrado respecto a su generación de egreso o titulación.
- Presentar dominio en ingles nivel intermedio o avanzado (que pueda llevar una conversación y discusión de ideas científicas).

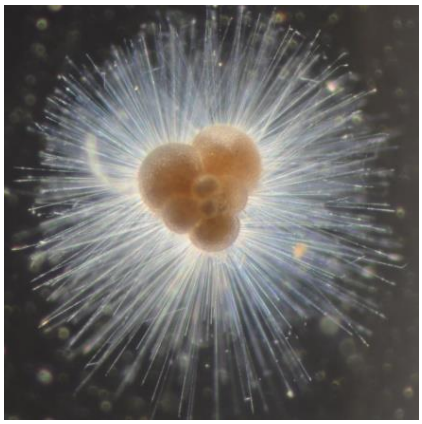
El estudiante seleccionado, va a recibir ayuda en el proceso de postulación por parte de los investigadores doctorales en paleoceanografía, de nuestro grupo de investigación: Dr (c) Dharma A. Reyes Macaya y Dr (c) Sebastián Garrido.

El estudiante si recibe la beca, se le ofrecerá un entrenamiento antes de empezar la tesis doctoral en biología molecular y geoquímica marina por parte de los investigadores de CEAZA y del Centro Lyell/UPWELL/MARUM.

Interesados enviar un mail **antes del 3 de abril 2022** en inglés a clare.bird2@stir.ac.uk con copia a B.Hoogakker@hw.ac.uk, kenagayoh@gmail.com, kd38@stir.ac.uk y carlos.henriquez@ceaza.cl con 1) certificados al día requeridos para la postulación (o probar que se pueden obtener antes del 15 de Abril) 2) CV 3) pequeña introducción (en el email) sobre ustedes explicando sus motivaciones para postular a Becas Chile con nosotros.

Instituciones patrocinantes y colaboradoras en el proyecto NERC

Descripción del proyecto de tesis doctoral en ingles



*During this PhD you will collect and work with marine planktonic foraminifera from the Humboldt Current System (HCS) off Chile. You will acquire skills in **molecular biology** (genotyping and metabarcoding), **geochemistry** (laser ablation) and **electron microscopy** to develop understanding of the HCS through time. This work will contribute to the development of tools for the reconstruction of past climates; a requirement for ground-truthing climate models.*

Photograph by J. Fehrenbacher

Background: The Humboldt Current System (HCS) of the southeast Pacific Ocean is one of the most complex and productive upwelling systems in the world, which supports large fisheries on which the people of the region depend. It is heavily influenced by the cycles of El Niño–Southern Oscillation (ENSO) and recent evidence shows that the coastal upwelling dynamics are changing, potentially forced by global warming. This has cascading impacts on the coastal ecosystems, threatening the world's largest fishery, and negatively affecting oceanic and terrestrial biodiversity and

the food security and livelihoods of resident populations. Predicting how ENSO patterns will alter the HCS as climate changes, is one of the biggest challenges in climate science today.

To model future climate scenarios, it is important to understand how the regional climate has changed in the past in response to previous global warming. To do so, we use the assemblage and chemical composition of shells of microscopic marine planktonic organisms called foraminifera (forams) as "proxies" for past conditions. Because these shells accumulate in the seafloor sediments over hundreds of thousands of years, we can use them to reconstruct oceanic and climatic conditions in the past. In this way the foram fossil record represents the foundation stone of palaeoceanography, providing an unparalleled long-term dataset with which to test and improve models for climate change projections.

The use of forams as a palaeoceanographic tool, however, needs to be filtered through a lens of biological understanding. The differing biology of foram species influences shell composition, leading to the routine use of species-specific proxies by palaeoceanographers. However, more recent research has shown that many species have evolved into genetically distinct groups called genotypes, driven by exploitable diverse niches in the water column. We now know that genotypes may look alike and contribute to the same fossil record. Yet, they occupy different niches, interact with different organism and/or are separated seasonally, all of which influence shell composition and lead to a requirement for genotype-specific proxies. Grouped as a single species in the fossil record, these genotypes supply an average temperature for the region, which is useful for understanding past climate over long time scales. However, analysing each genotype independently, or indeed analysing single specimens to understand changes in seasonal patterns through time allows for a much more refined understanding of changing oceanographic and climate patterns. This of course requires knowledge of the genotypes present and their biological preferences, both of which are currently unknown in the HCS, as it is the last remaining globally important oceanographic region to be genetically assessed.

The overarching aim of this project is to establish the foraminiferal species and genotypes present in the upwelling and OMZ waters of the HCS. We will then use our developed molecular approach to link these genotypes to their unique biology. We will combine this molecular data with eSEM imaging of genotyped individuals and genotype-specific measurements of shell composition to develop genotype-specific proxies. These methods will be directly applicable for research in other ocean regions and will provide palaeoceanographers with the most accurate tools to reconstruct past oceanic conditions, and climate modellers with finely tuned seasonal datasets for ground truthing of climate models.

Requirements: It would be advantageous for the successful candidate to have some experience or motivation to work in at least one of the following: molecular biology; shell geochemical analysis; eSEM; foraminiferal geology. Training will be provided before and throughout the PhD in each of these areas. At least level B1 in English is required for this position.

The program: This PhD will be part of a wider NERC UK funded project "Disentangling the Genotype Palaeoproxy Challenge in the Humboldt Current System and Beyond." The focus of this PhD project will be on 16S metabarcoding of single specimens to document their genotype, their trophic and microbial interactions, along with documentation of metadata to identify their preferred environmental/physico-chemical conditions. There is also some methodological development associated with the project, for e.g., DNA extraction buffer testing for its influence on shell geochemistry. Importantly, to test potential morphological and geochemical links to genotype and the fossil record, the shells of genotyped individuals will be imaged using environmental scanning electron microscopy (eSEM) and analysed geochemically. In addition, the PhD student will gain experience in participating in short cruises in the southeast Pacific and will receive training in catching live foraminifera using plankton nets.

This studentship will begin with two tasks. Firstly, a literature review will be necessary for the candidate to get a broad understanding of the topic. Secondly, the candidate will be involved in the planning and preparation for the field work and will take part in the field work off the coast of Chile during January 2023. The second six months will be used to train the candidate in the methods required (genotyping, metabarcoding, eSEM) and to begin processing the samples collected off Chile. Relevant training in QIIME and/or R will be accessed during the first year.

Metabarcoding and data analyses should be completed during year 2, including analysis of both water and foraminiferal samples. The student will also carry out the testing of DNA extraction buffers and perform DNA extractions while retaining shells from genotyped specimens for geochemical analysis and eSEM. This data will be used to link genotype to the corresponding shell geochemistry and morphology.

During year three, shell processing will continue, progressing to eSEM imaging and morphometrics. The student will then visit our collaborator at the University of Western Australia where they will train in the geochemical analysis of the shells of single specimens, using laser ablation of genotyped and imaged specimens to measure elemental ratios in the shell.

Stirling University: This PhD will be held in the vibrant and multidisciplinary research environment at the University of Stirling, in Scotland. The PhD student will become part of the "Environmental Biogeochemisty" research group and attend regular group meetings, along with the weekly seminar series giving informal and formal opportunities for research presentations. The student is also expected to participate in the yearly Postgraduate Conference attended by the entire department, and to contribute to international conferences. Strong links will be maintained with project partners at Heriot Watt University which has an energetic geochemistry based foraminiferal research group led by co-supervisor Dr Babette Hoogakker. The PhD student will receive training in subject specific and generic skills. Specific skills will include foraminiferal sampling and shipboard work (including sea survival training), molecular techniques and bioinformatics. The PhD student will also be encouraged to take on additional bioinformatics training courses if required. The student will also be expected to participate in training opportunities in a range of research and transferable skills offered at Stirling.

Public Outreach: There will be opportunity to take part in public outreach with Chilean co-supervisors in the production of a bilingual short documentary film about the project. In the UK there will be opportunity to produce materials for and take part in science week aimed at school children.

Support for this application: You will be assisted by Dr (c) Dharma Andrea Reyes Macaya and Dr (c) Sebastian Garrido (Beca's Chile scholar holders from the working group of Dr Babette Hoogakker) in the preparation of your documents for application.

Supervisory Team: Dr Clare Bird and Professor Kate Darling (University of Stirling), Dr Babette Hoogakker (Heriot Watt University), Dr Eugenia Gayo (University of Concepcion, and Director of Millenium Nucleus UPWELL), and Dr Carlos Henríquez (CEAZA).