ONE Planet Doctoral Training Partnership

Natural Environment Research Council

Project title: Deep Antarctic Subglacial Lake Exploration: Diversity, Geochemistry and Ecology

Ref: OP2420

Keywords: Antarctic, Subglacial, Microbiology, Resilience

One Planet Research Theme:

Climate & Climate Change ☒ | Earth System Processes ☒ | Anthropocene ☒ | Environmental Informatics ☒

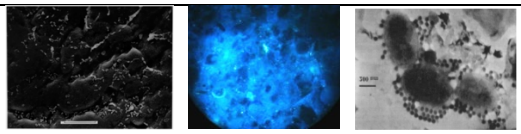
Lead Supervisor: Professor David Pearce, Northumbria University

Key Research Gaps and Questions:

1. What are the key functions of deep Antarctic subglacial bacteria?

2. Are they closely associated with or specific to the habitat and selective pressures found?

3. Would they impact the external environment if the ice were to melt and release this genetic material?



Microorganisms are likely to play an increasingly important role in the Earth's climate system and are known to directly affect biogeochemical cycles – currently we know little about the role of subglacial bacteria

Project Description: Antarctic subglacial ecosystems have intrigued scientists since they were first discovered in the 1970s. Since then, many hundreds have been identified and indeed the subglacial environment has even been described as a continuous interconnected wetland. A number of ground-breaking projects have studied such systems and their analogues, and further, wherever we have searched for life, it has usually been found. Such is the ubiquity of life, that we are still unable to state definitively the exact physicochemical envelope that constrains life. The complexity of environmental, physical, and chemical interactions, and the metabolic flexibility of microorganisms, means that strong selection pressures in the absence of competition lead to a bewildering array of highly specialised adaptations. Hence the search for life continues, escalated by the growing interest in the search for life elsewhere in the solar system. The long-term isolation of subglacial sediment raise the prospect that the microbiota it contains are distinctive and their role and environmental function shaped by their response to energy limitation. It is likely that subglacial microbiota under conditions which favour the persistence of microbes adapted to low growth states, dormancy, and energy limitation. We expect such strategies have protected microbiota from local extinction during their long-term entombment. In this study we will take advantage of cultures and genetic material recovered from beneath the Antarctic ice sheet during the BEAMISH project (https://www.bas.ac.uk/project/basal-conditions-on-rutford-ice-stream/) to investigate the colonization potential of external environments, resilience and functional potential of microbial life obtained from subglacial ecosystems. In this project we will use comparative genomics, environmental metagenome libraries and experiments with cultures to investigate what is unique about microorganisms found in this inhospitable environment, what their key functional roles are in the environment and determine whether these functions might alter the surface environment if the microbes were to be disseminated following glacial melt. Pearce, D et al. (2015) Phil Trans R Soc A: 374 (2059). p. 20140291. Pearce, D et al. (2013) Diversity, 5 (3). pp. 680-702. Pearce, D (2012) Subglacial lakes. ISBN 9781845938147. Siegert, M et al. (2012) Reviews of Geophysics, 50. RG1003. ISSN 0096-1043. Pearce, D (2009) The ISME Journal, 3 (8). pp. 877-880.

Prerequisites: Essential: Knowledge/experience of experimental microbiology and/or chemistry. Desirable: Some knowledge/experience of bioinformatics & statistics. For more information, please contact david.pearce@northumbria.ac.uk

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