

Penguins as vectors for contaminant transport in pristine Antarctic environments



THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

This fully funded three-year PhD studentship will be based at Te Aka Mātuatua – School of Science, Waikato University in Hamilton, New Zealand. As part of a Marsden Fund fast-start research project, the successful candidate will be an integral part of at least one field work campaign in Antarctica. An early to mid-year 2022 start is anticipated; with flexibility in responding to COVID-19 related travel restrictions.

BACKGROUND: Antarctica, by virtue of its geographic remoteness and short history of human occupation, is one of the least anthropogenically polluted regions on Earth. However, increasingly, contaminants such as microplastics, persistent organic pollutants (e.g. DDT) and heavy metals (e.g. lead, mercury) are being documented in Antarctic ecosystems, challenging the theory that major current systems of the Southern Ocean provide a substantial barrier for long-range transport of contaminants from lower latitudes.

PROJECT: This project aims to determine if Adélie penguins, through their foraging and nesting activities, transfer and preserve the contaminants from global-scale anthropogenic events (e.g. the Industrial Revolution, Great Acceleration, peak DDT, and microplastic incursion) in terrestrial Antarctica. We will also investigate if we can identify a chronology of hemispheric-scale pollution and local-scale Antarctic events, as well as the effects of pollutant moratoria and/or abatement technologies on contaminant concentrations. This project will be the first to construct a history of contaminant transfer and accumulation in ice-free terrestrial Antarctica, using penguin mounds as a natural archive. Complementary work will be carried out in a New Zealand seabird colony setting.

Specific objectives will include: (i) radiocarbon- date organic samples from penguin mounds and known-age remains to obtain a robust chronology of contaminant accumulation; (ii) measure the concentration of anthropogenic contaminants (e.g. lead, mercury, DDT, microplastics) in soil, bone, feather, and eggshell samples from active and abandoned mounds, and non-penguin-influenced control sites, using a range of spectroscopic analytical techniques; (iii) determine the provenance of lead contamination using isotopic ratios; and (iv) assess the temporal resolution at which we can pinpoint geochemical signatures of global-scale (e.g. Industrial Revolution, peak DDT use), hemispheric-scale (e.g. commissioning of Australia's Port Pirie smelter), and local-scale (e.g. commissioning of Hallett Station) events in penguin mound records at Cape Bird and Cape Hallett.

The project will involve one or two, 4- to 6-week Antarctic field campaigns in December 2022/January 2023 and/or December 2023/January 2024 (camping in a team of three or four experienced individuals). Soil, guano and organic samples will be taken and the student will undertake a range of complementary techniques including geochemical analyses, spectroscopic identification, and radiometric geochronology methods, to address our objectives.

The research will make a significant contribution to understanding the magnitude of transport and cycling of contaminants via penguins as biovectors in the Antarctic environment. Through a combination of elemental and isotopic analysis, and ¹⁴C-dating of in-situ remains, this research will provide a chronology of contaminant transfer and accumulation in Antarctica, as well as insight into the dynamicity of the marine reservoir correction for the Ross Sea region.

SUPERVISORS: The PhD candidate will be supervised by Dr Tanya O'Neill (Waikato University, New Zealand) and Prof. Sally Gaw (Canterbury University, New Zealand).

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Eligibility criteria:

The successful candidate will have:

- (1) a master's degree in a relevant discipline (e.g., environmental science, geochemistry, analytical chemistry, soil science);
- (2) demonstrated skill and proficiency in analytical techniques ICP-MS, IC, and preferably microplastic or similar FTIR analysis;
- (3) previous experience (or a demonstrated interest) in cold regions;
- (4) confidence and appropriate fitness for working in challenging environments (i.e. Antarctica) as well as
- (5) demonstrated English language skills (if English is not your first language, TOEFL or IELTS scores should be submitted with your application if available).

This PhD studentship is fully funded and consists of a \$27,500 stipend per year for 3 years plus domestic fees. Domestic or International students welcome to apply. We will consider how the pandemic / border situation is looking at the time of selection.

Application documents required:

- Cover letter
- CV with copies of academic transcripts and TOEFL/IELTS scores
- A personal statement (max 2 page) **related to the research project** (*including why you care about Antarctica, what is your experience and motivation to work with contaminants, and what experience and skills you will bring to the team and project*)
- Contact details of three references (at least two academic).

Please send all of the above to Dr Tanya O'Neill (toneill@waikato.ac.nz). Incomplete applications will not be considered. Review of applications will begin Dec 1 2021 and continue until the position is filled. Final acceptance is subject to the approval of the University of Waikato postgraduate studies office.

Contact and email address for applications:

Dr Tanya O'Neill
toneill@waikato.ac.nz

Closing date:

Ongoing review of applications from 1st December 2021.