

Life in the extreme: When did the water bears (Phylum Tardigrada) colonised Antarctica?

Supervisors

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Project description

Tardigrades are extremely resilient, microscopic animals, with the ability to undergo cryptobiosis, and survive exposure in space. Tardigrades have a global distribution, including in Antarctica¹, a continent that has been isolated and permanently glaciated for ~34 Million years. This project proposes to study the Antarctic tardigrades and determine whether they colonised this continent before it became isolated, i.e. before the Antarctic Circumpolar Current restricted invasive colonisers. The alternative hypothesis is that extant Antarctic species represent recent invaders that were pre-adapted to the harsh Antarctic conditions and colonised the continent after it froze. The target species for this study are *Acutuncus antarcticus* – a species with pan-Antarctic distribution, and *Macrobotus furciger* – a cosmopolitan genus that is well represented in Antarctica.

The first part of the project will focus on *Macrobotus furciger*. Frozen samples spanning the Antarctic Peninsula and Continental Antarctica will be analysed and individuals identified using traditional and molecular techniques. Potential new species from what is believed to be a *Macrobotus furciger* species complex, will be described. Phylogenetics will be used to identify distinct species and populations, and further transcriptomic, phylogenomic, and molecular clock approaches will be used to test alternative hypotheses for the colonisation of Antarctica by *Macrobotus*. In the second phase of the project samples of the pan-Antarctic *Acutuncus antarcticus* will be used to investigate how this species was able to colonise the entire continent. The student will test whether populations of *Acutuncus antarcticus* survived, in refugia, the successive waves of glaciation and recolonised the continent at each interglacial, or whether they colonised it only once and survived glaciations without the aid of refugia. Transcriptomic experiments will finally be used to explore the life histories of both species and whether this reflects the way each species copes with living in extreme conditions.

The student working on this project will gain deep knowledge of taxonomic methods (in Modena, Italy), the biology of a fascinating animal phylum (the Tardigrada), including setting up and maintain colonies in the laboratory, the use transcriptomics and comparative genomics (including phylogenetics) and bioinformatics in ecology and evolution, and there could be scope for Arctic Fieldwork Training (at the [NERC Ny-Alesund](#) station). While the project has precise aims there is abundant scope for the student to take a leadership role and direct part of the project towards their specific interest. Finally, there is potential for collaborating with Antarctic BAS missions.

¹ Convey et al. 2008. Biol.Rev. 83:103-107.

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