Probing ancient Antarctic krill populations

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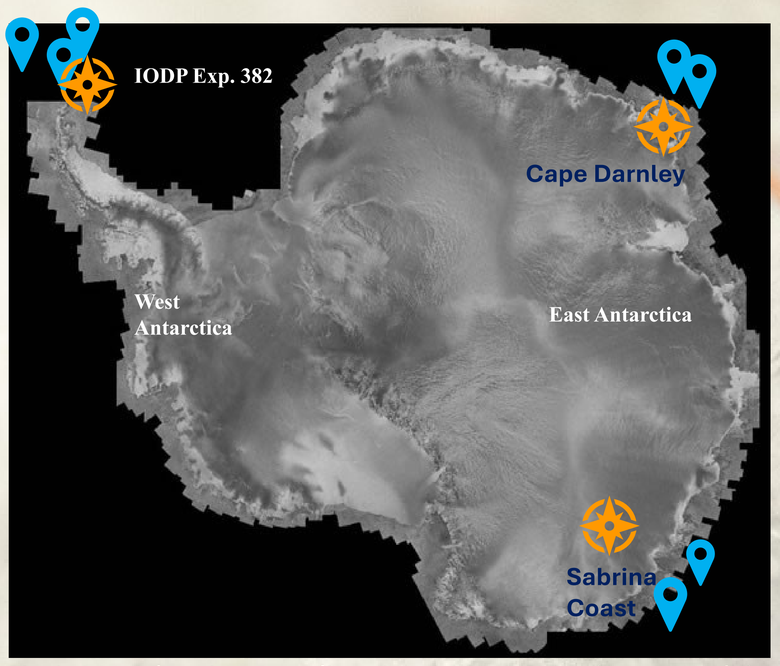

Fig.1. Map showing sampling sites in Antarctica (not to scale).

Background

Antarctic krill, vital in Southern Ocean ecosystems, face threats from climate change such as ocean warming and acidification, reduced sea-ice habitat and overfishing.

Understanding their response to past environmental changes is crucial for predicting their adaptability to ongoing climate change and aiding conservation efforts.

To date, such paleo studies targeting krill have been impossible, as krill leave no fossil records.

Our Goal

To investigate Antarctic krill population dynamics over hundreds of thousands of years by looking for their sedimentary ancient DNA (*sed*aDNA) from Southern Ocean sediment cores using an RNA-based hybridization-capture technique (Fig.3).

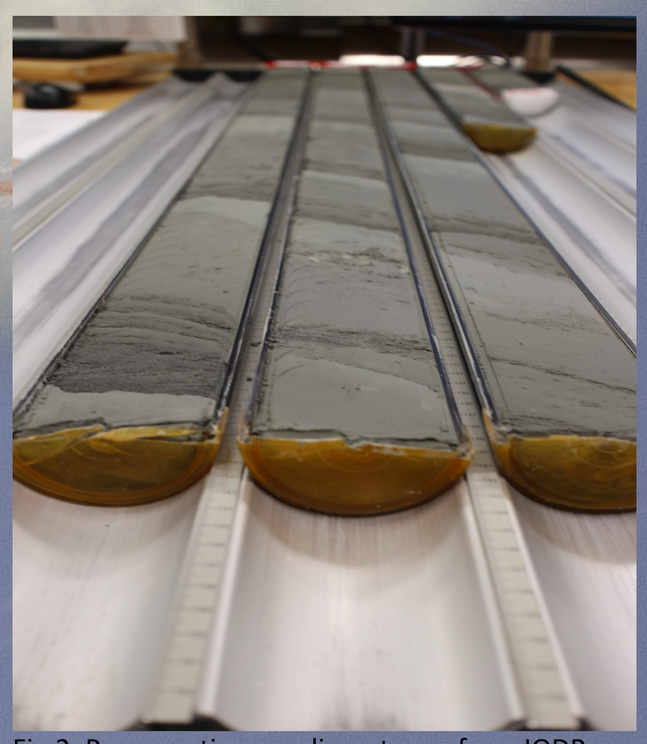

Fig.2. Representing a sediment core from IODP (Image source: Aliki Weststrate, IODP)

What is *Sed*aDNA? *Sed*aDNA as a paleoproxy?

*Sed*aDNA is DNA from dead organisms that have sunk from the ocean to the seafloor, forming a record of "who" has inhabited the ocean in the past.

It allows us to study past marine biodiversity comprehensively across different levels of the food web uncovering wide-scale community shifts as a response to past climatic change.

Note: *Sed*aDNA is ancient DNA (aDNA) found in sediments (Fig. 4).

Suitable conditions for preservation of *sed*aDNA?

Polar deep-ocean environments are particularly suitable for *sed*aDNA preservation. Low temperatures, low oxygen concentrations, and the absence of UV radiation are beneficial.

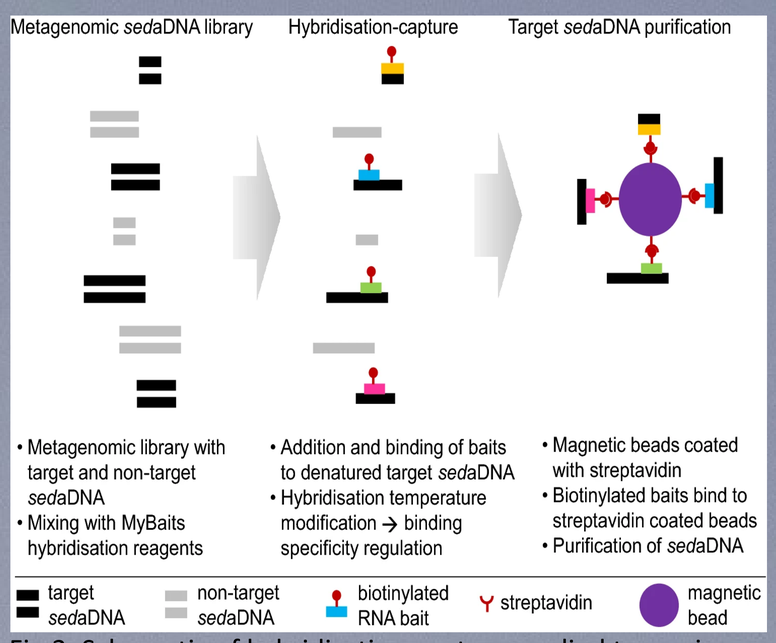

Fig.3. Schematic of hybridisation capture applied to marine sedimentary ancient DNA (sedaDNA) in three main steps (Armbrecht, et al., 2021).

What are 'baits'?

'Baits' (analogous to the baits used in a fishing context) are short RNA probes designed to be complementary to any chosen DNA sequences (e.g., specific genes of a target organism). By binding to the target sequence, the baits can capture DNA fragments of interest and make sequencing more efficient and cost-effective (Fig.3).

Application of the 'krill baits':

The krill baits will be applied to *sed*aDNA extracts from the East Antarctic Sabrina coast (IN2017_V01), Cape Darnley (IN2023_V01), and West Antarctic Iceberg Alley (IODP Exp. 382). Refer to Fig. 1 (map on the top left).

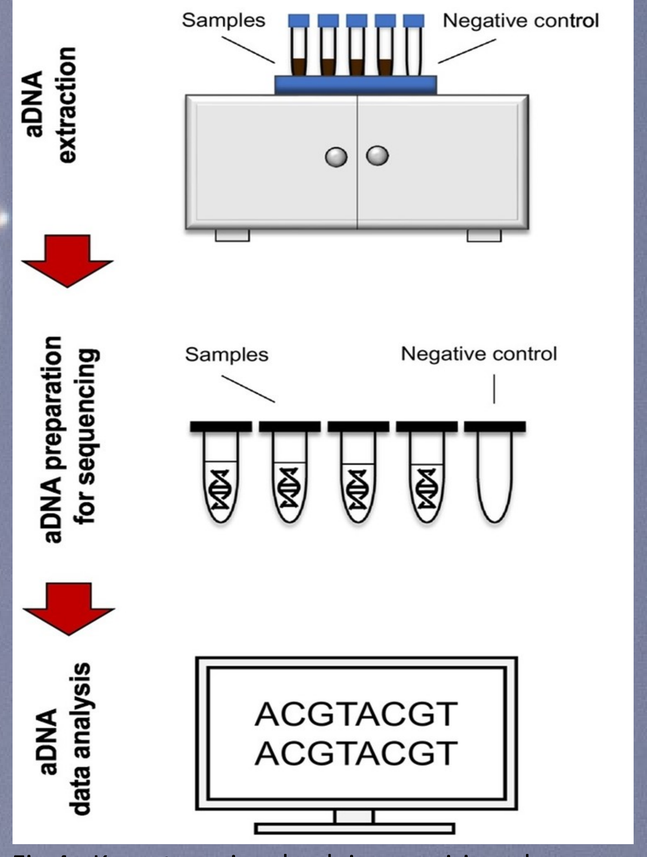

Fig.4. Key steps involved in acquiring deep sea sediment cores, subsampling, DNA extraction, aDNA preparation for sequencing and data generation (Armbrecht, et al., 2019).

References:

- Armbrecht, L., 2022. Sedimentary ancient DNA (sedaDNA) as a new paleo proxy to investigate organismal responses to past environmental changes in Antarctica
- CORE SCIENCE #1 – WHAT IS CORING AND WHAT DOES IT TELL US? by Aliki Weststrate – JOIDES Resolution, On board Expedition 375
- Armbrecht, et al., 2021. Hybridisation capture allows DNA damage analysis of ancient marine eukaryotes. *Scientific Reports*, *11*(1), p.3220
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