

# From the Surface Ocean to the Seafloor: Linking Modern and Paleo-Genetics at the Sabrina Coast, East Antarctica (IN2017\_V01)



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## Introduction

The **Totten Glacier region, Sabrina Coast**, is currently experiencing some of the highest rates of thinning across all East Antarctica (Li et al., 2015, Rignot et al., 2019).

An assessment of the **microscopic organisms** supporting the ecosystem of the marginal sea-ice zone over the continental rise is important, yet there is a lack of knowledge about the diversity and distribution of these organisms throughout the water column, and their occurrence and/or preservation in the underlying sediments.

This study provides the first assessment of **DNA** transfer from **ocean waters to sediments** and an overview of the microscopic communities occurring in the climatically important Totten Glacier region.

Such knowledge is important when reconstructing past ecosystems using the emerging **sedDNA** approach as a new **paleo-proxy**, and the interpretation of biological changes in response to Antarctic ice sheet advances and retreats.

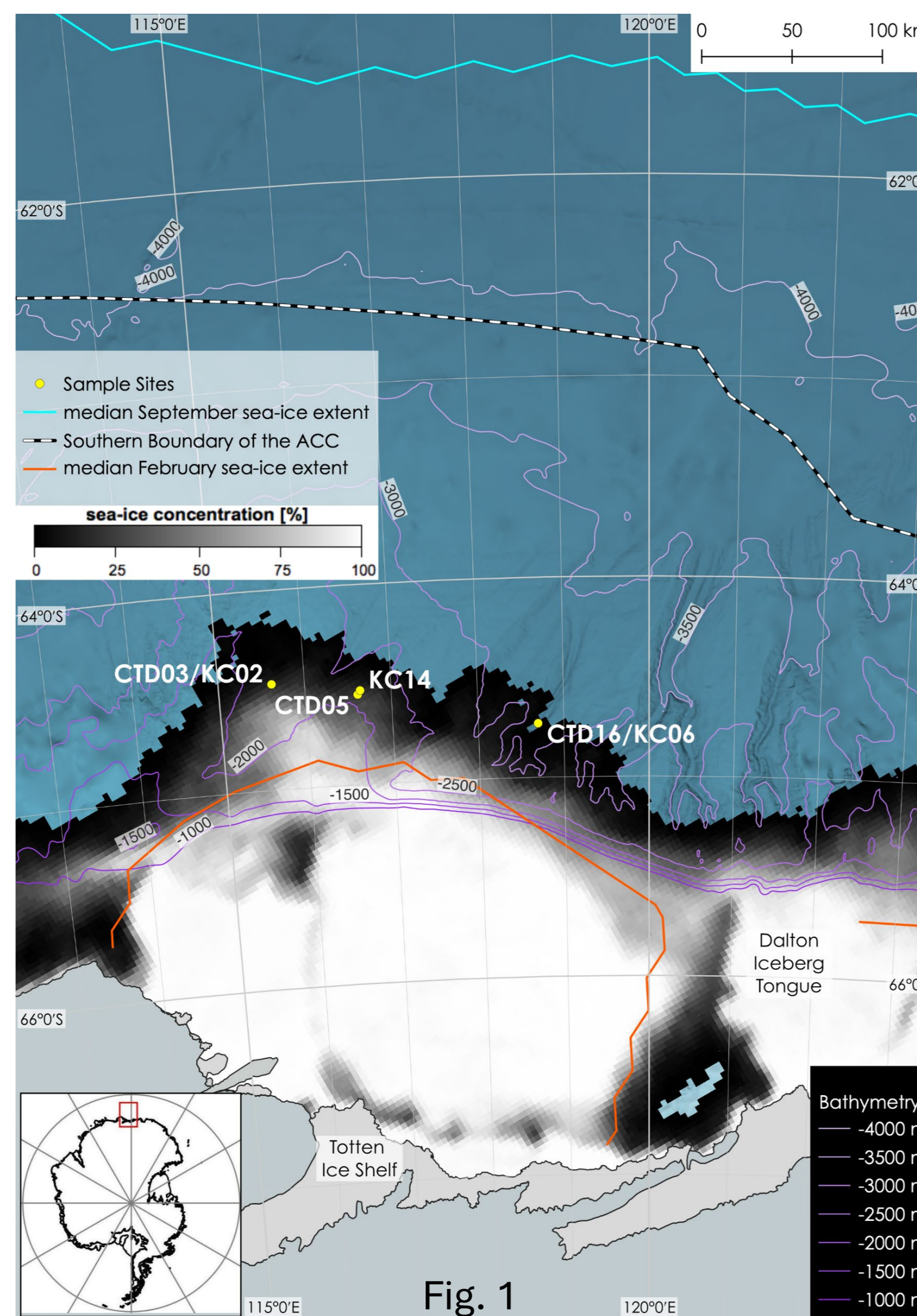


Fig. 1

## Methods

Water samples and sediment cores were collected during the **'Sabrina Seafloor Survey'** on board RV *Investigator* IN2017\_V01 (Jan – Mar 2017, Armand et al., 2018; Fig. 1).

**Modern DNA**, collected on Sterivex filters, was extracted using a commercial kit (Power water, QIAGEN). Amplicon sequencing was undertaken for the V1–V3 region of the 16S rRNA gene and the V4 region of the 18S rRNA.

**Sedimentary ancient DNA (sedDNA)** was sampled and extracted using ultraclean procedures and previously optimised protocols (Armbrecht et al., 2020). Meta-genomic sequencing libraries were prepared.

Modern and ancient reads were taxonomically identified using the SILVA v.132 database (<https://www.arb-silva.de/>).

Age models for KC02 and KC14 were developed by radiocarbon dating, lithological observations and diatom quantification. For KC06, an age model is not yet fully established, with the oldest sediments potentially being from the Holocene or Last Interglacial.

X-ray fluorescence (XRF; incl. Si/Al), Magnetic susceptibility, and biogenic silica were measured in each core (Fig. 2).

## Results & Interpretation

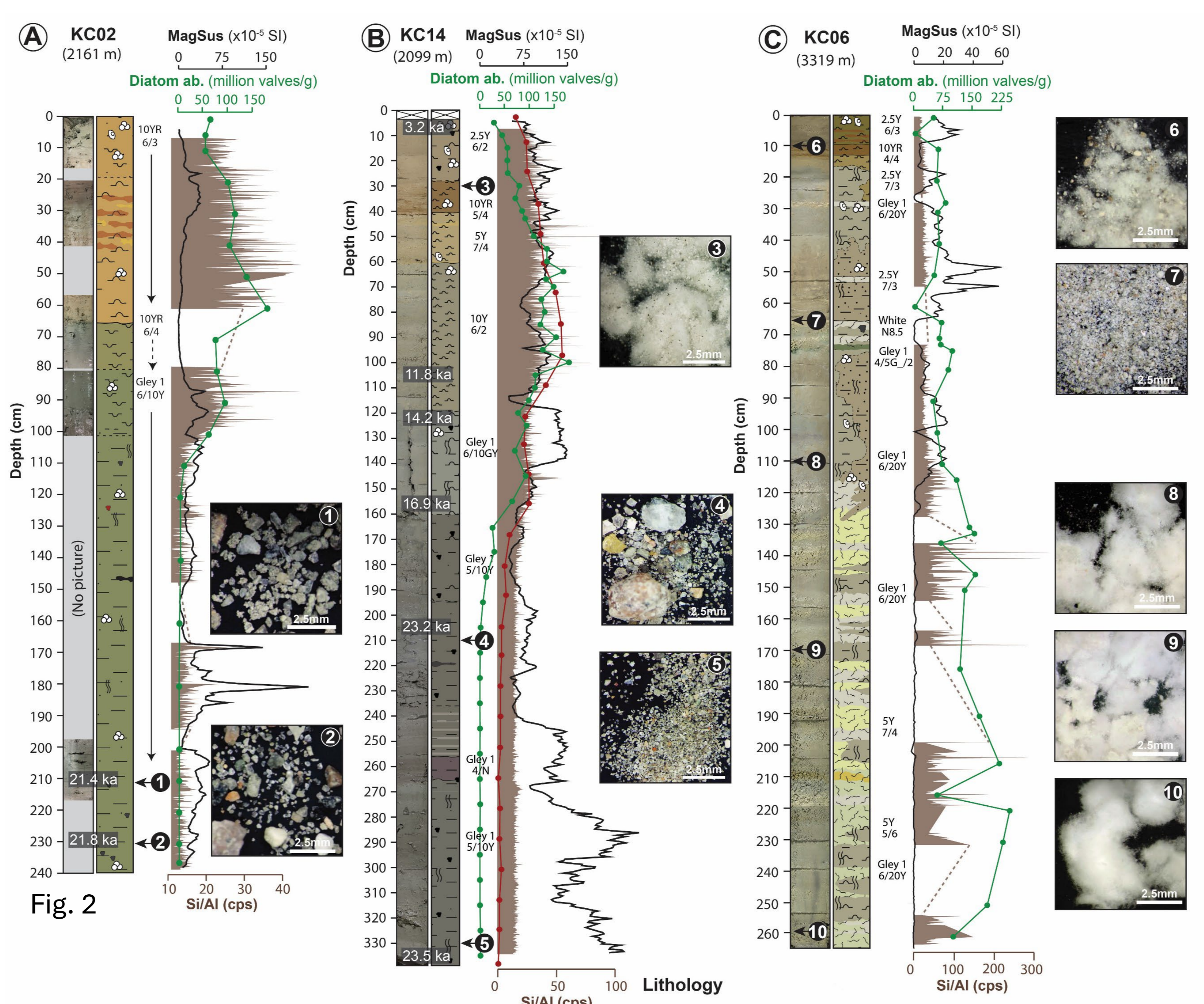


Fig. 2

### Sediment core lithology:

Radiocarbon dates combined with lithological observations and diatom abundance data show that KC02 and KC14 show a transition from glacial sediments to diatom-rich Holocene sediments at ~100-150 cmbfs, respectively (Fig. 2). KC06 consists primarily of diatom ooze with no clear glacial-Holocene transition signal (Fig. 2).

**Conclusion:** This study reports the first bacterial and eukaryote taxonomic profiles from surface water to deep ocean to sediments in the Totten Glacier region of Antarctica. We show that degradation of DNA with increasing water depth is a major driver of what DNA becomes preserved in the sediments (especially, for surface-dwelling organisms in a deep water column) and ultimately will impact on the paleo-environmental reconstructions.

### Prokaryotes:

**Proteobacteria** (especially SAR11) dominate the bacterial composition in the water column (Fig. 3). This was expected, given their reported high abundance in all oceans and water depths (Zhou et al., 2020).

Proteobacteria DNA was relatively well preserved in sediments, likely stemming from a mix of intact and ancient DNA. Proteobacteria are often found in diatom-dominated waters (Cho et al., 2020; Learman et al., 2016), and their *sedDNA* signatures may be useful for indirectly reflecting past diatom presence.

### Eukaryotes:

**Diatoms** (purple) dominate the eukaryote composition in the upper water column and decrease with water depth, as do dinoflagellates, and haptophytes (Fig. 4). Notably, little diatom *sedDNA* is preserved in the sediments, which are instead dominated by **Retaria** (in particular, *Collophidium* a group of deep water **Radiolaria** that lack siliceous skeletons (Pernice et al., 2016).

We link the weak preservation of diatom, dinoflagellate and haptophyte *sedDNA* to DNA degradation while sinking through the water column to the seafloor, rather than degradation after burial.

