First results from the EPICA-DML ice core

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Introduction

The EPICA-DML Ice core is being retrieved from Kohnen Station, Dronning Maud Land (Antarctica).

This drilling aims to obtain a high-resolution climate record from the Atlantic sector of Eastern Antarctica.

Drilling reached a depth of approx. 2560 m in the field season of 2003/2004.

During the summer of 2004, more than 2100 m of ice need to be processed in the CFA-Lab, which is done in the labs of AWI, Germany.

After the unfortunate loss of the Swiss CFA-equipment, the system was rebuilt in a cooperative effort of the University of Bern and the Alfred-wegener-Institute. The system-rebuilt included a number of improvements, including:

• Only one valve switches between blank and melt head simultaneously for all components.

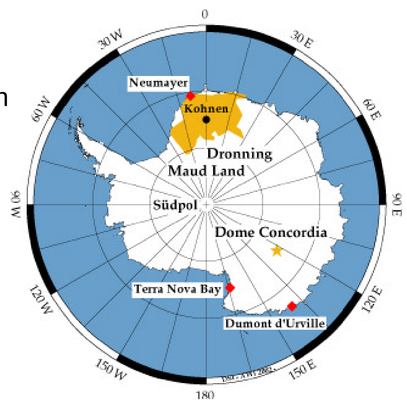
• Objective quantification of detection-delays for each component

• Development of fast data evaluation methods

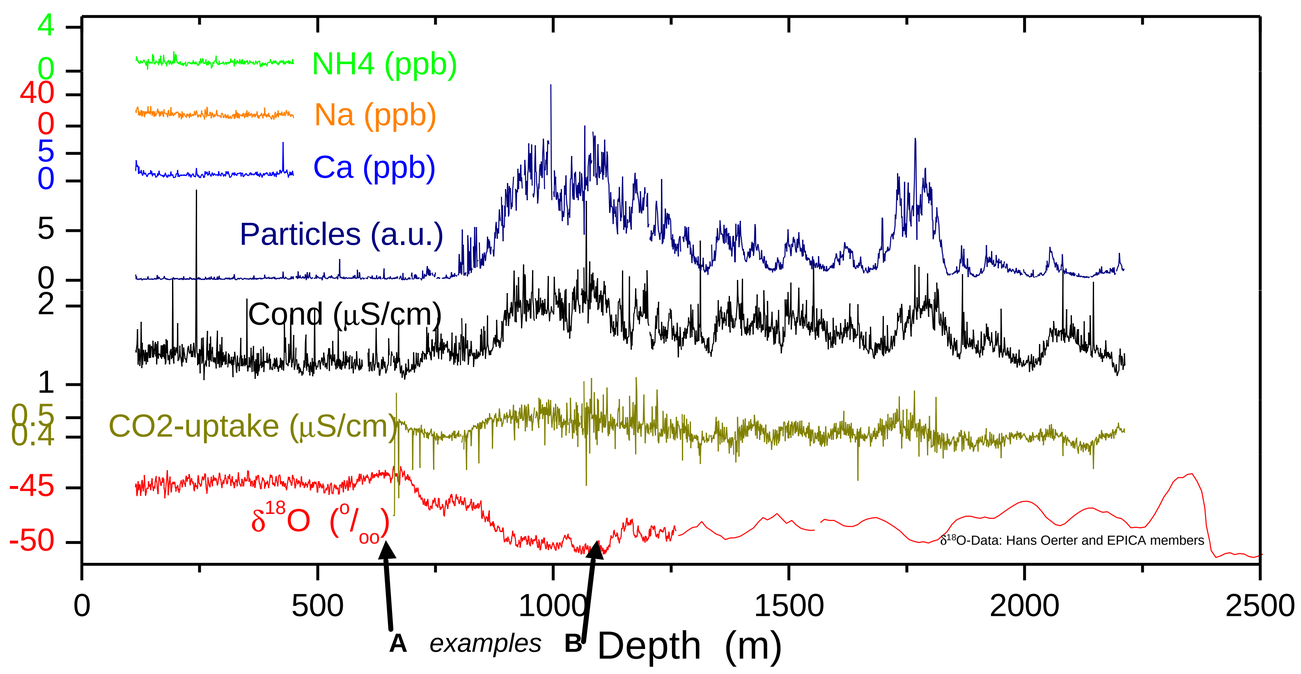
Here we give an overview of the ongoing CFA-measurements. We show first results focussing on the following topics:

• Present an overview of the data alreay available.

• Can annual layers still be identified in the last gacial period?



Profile overview



→ **Fast data evaluation procedures:**
While previously it took months or years to process the CFA data we now are able to present first data at 1 m averages already three weeks after processing terminated. We will continue to develop fast data processing methods for the components that are still missing.

→ **Shape of profiles:**
The continuous microparticle concentration profile resembles clearly the well-known one from Dome-C, which makes it possible to preliminarily transfer the Dome-C time scale to DML.

→ **Electrolytical conductivity:**
Conductivity is measured two times: once directly and once after the sample has come to equilibrium with a controlled reservoir of CO_2-saturated water; thus the CO_2-uptake is measured.

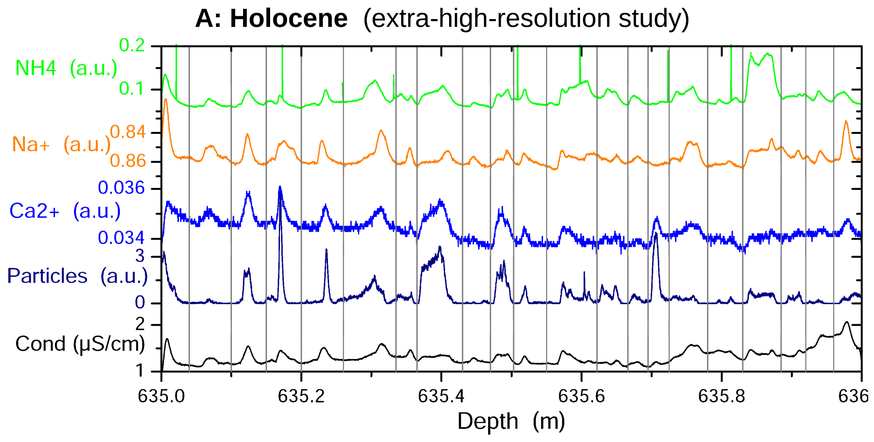
-The CO_2-uptake clearly shows climatic variations.

-The phasing of the variations possibly parallels the particle concentrations.

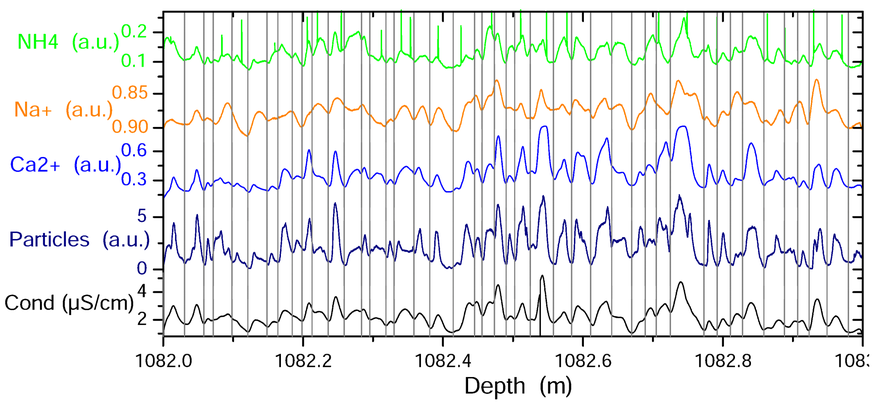
- The quantitative understanding of the CO_2-uptake will be subject of future work.

Identification of annual layers

A: Holocene (extra-high-resolution study)



B: LGM (extra-high-resolution study)



A Holocene:

→ All components (NH4, Na, Ca, particles) show seasonal variations throughout Holocene.

→Although unequivocal counting of annual layers will be a challenge this should be an independent dating approach.

B LGM:

→ **<u>Also during LGM seasonal variations are detectable in the DML ice core</u>** – at least at selected intervals and during the extra-high-resolution study **!**

Exemplary determination of annual layer thickness:

A Holocene:

λ = 4.8 cm
$\lambda_{surface}$= 6.1 cm (˜ 55 kgm^{-2}a^{-1})
recent accumulation (1000-2000AD): ˜ 65 kgm^{-2}a^{-1}

B LGM:

λ = 2.3 cm
$\lambda_{surface}$= 3.8 cm (˜ 35 kgm^{-2}a^{-1})

Note that accumulation decreases uppstream of the drill site.

Seasonal timing

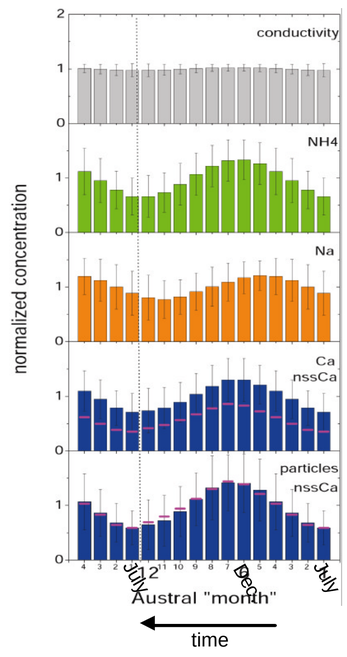
For Mid-Holocene approx. 140 years were divided into 12 equidistant layers (called “months”) each and stacked for each species. Taking peaks of microparticle concentration as a summer marker we find:

•NH4 peaks in mid-summer ; $\Delta t \approx$ - 0.2 months

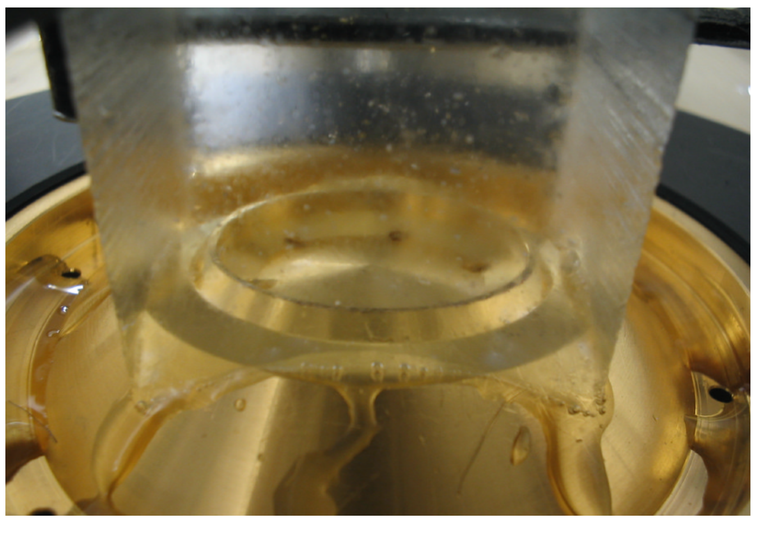
• Na peaks in spring; $\Delta t \approx$ - 1.8 months

• Ca peaks in mid summer ; $\Delta t \approx$ 0.0 months

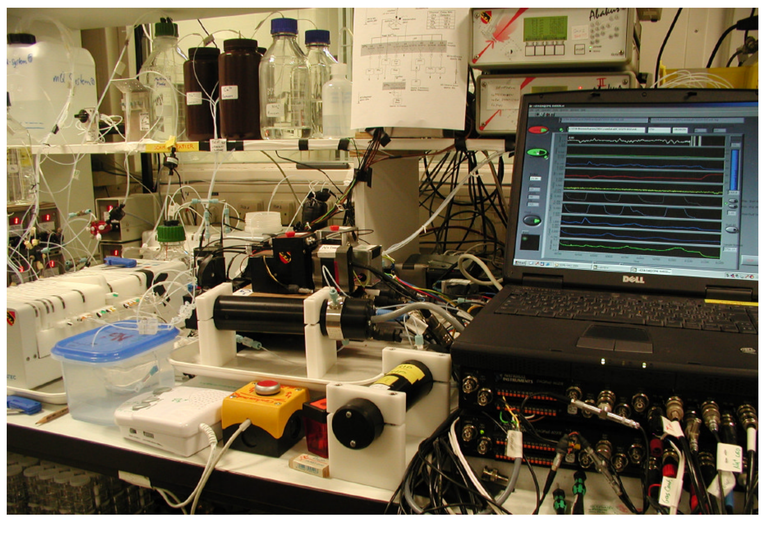
Ca sources (in Holocene):
60.0% soluble mineral dust
40.0% sea salt



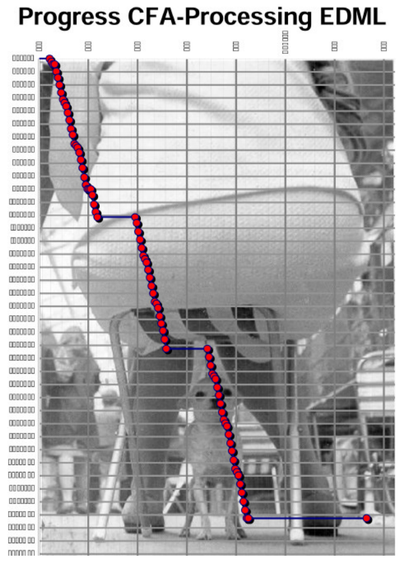
Ice on the melt head



The detection system inside the warm-lab



Progress CFA-Processing EDML



Taking the work load with humour...

The daily production in the CFA-lab was remakably constant after initial problems had been solved.
Average production amounts to 165 meters per week.
Within each of the three sessions one can identify the Sunday breaks.

Acknowledgements

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