Micro-inclusions in the EGRIP ice core identified with Raman-spectroscopy

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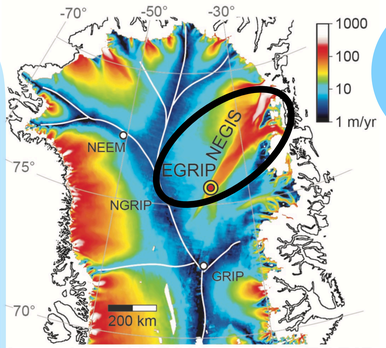
EASTGRIP ice core

EGU General Assembly

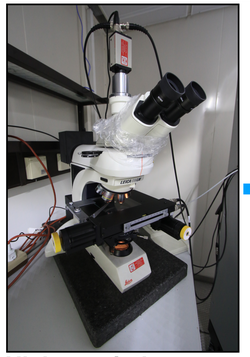
Motivation

Impurities and their microstructural locations are crucial to understand the deformation (i.e. flow) of ice. Thus, we systematically analysed ice from the upper 1340 m of the *East Greenland Ice Project* (EGRIP) ice core, currently drilled on the *Northeast Greenland Ice Stream* (NEGIS) in North-Greenland.

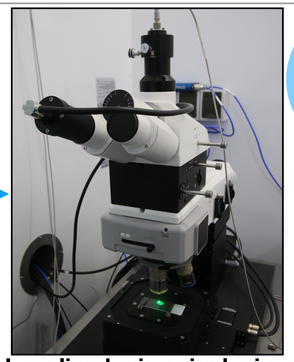


Location of NEGIS and the EGRIP camp. Colours indicate ice flow velocities (figure from Westhoff et al., 2020).

1

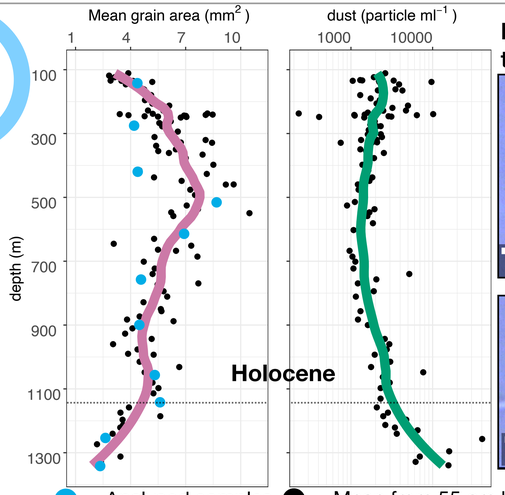


High-resolution microscope images of sample surface & 500 µm below surface.

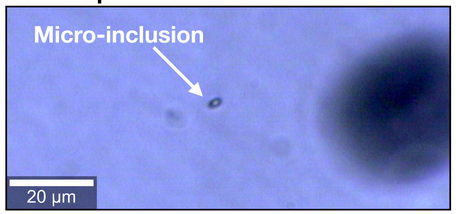


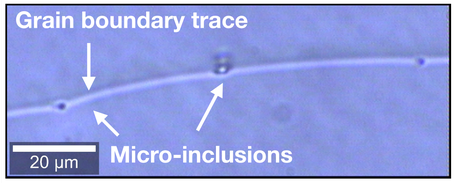
Localised micro-inclusions analysed with WITec alpha 300 M+ with Nd:YAG laser (532 nm) at -15°C.

2



Micro-inclusions 500 µm below the sample surface.





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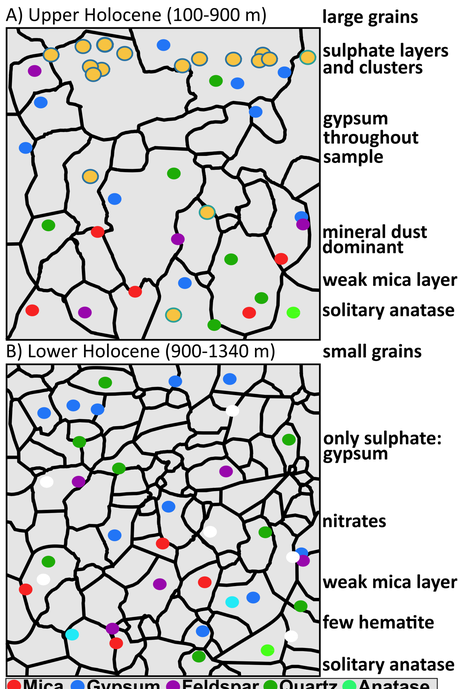
Simplified mineralogy-dependent spatial distribution of inclusions.



Key findings

1) 5800 micro-inclusions located in microstructure from 11 depths

2) Different spatial patterns (solitary, clusters, rows) of inclusions, depending on examined scale

3) ~33% of micro-inclusions close to grain boundaries (p-value >0.05 for 5/10 samples)

4) Diverse mineralogy of inclusions: sulfates (especially gypsum), quartz, feldspar, mica, hematite, nitrates

5) high sulphate diversity until 900 m, below only gypsum

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Most abundant minerals.

Mineral	Number	Number at grain boundary
Sulphates	386	92
Gypsum	170	47
Quartz	126	28
Mica	81	22
Feldspar	67	21

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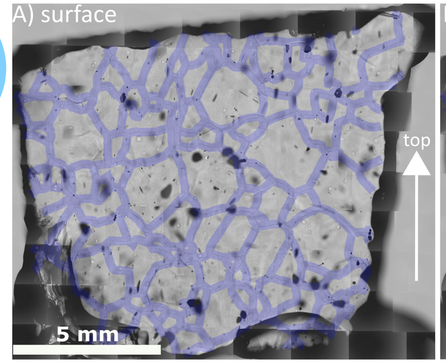
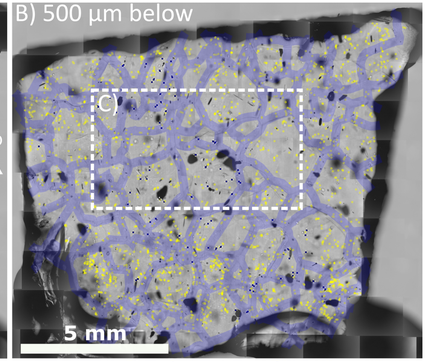
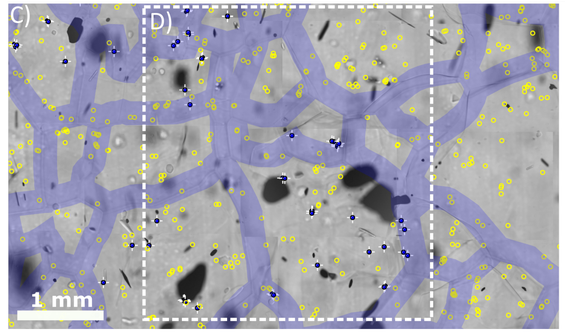
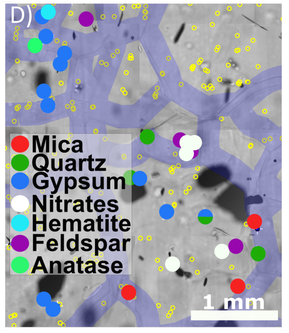
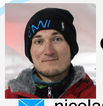
Localisation of micro-inclusions. Grain boundaries are indicated by 300 µm violet lines, yellow dots are micro-inclusions and blue crosses were analysed with Raman-spectroscopy.







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