

Reconstructing Greenland meltwater runoff using bivalve shell chemistry

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Greenland

Global warming causes accelerated melting of the Greenland ice sheet. As complete loss of this ice sheet would result in a global sea level rise of ~7 m, it is crucial to gain insight into its dynamics through time.

Instrumental data for Greenland cover the last few decades only. Modelling studies investigate both the natural variability in ice cap mass balance, and the influence of future global warming. Proxy data are essential for the validation of these models.

Question: Can the trace element and oxygen isotope composition of the shell of *Chlamys islandica* be used as a proxy for past meltwater runoff?

Methods



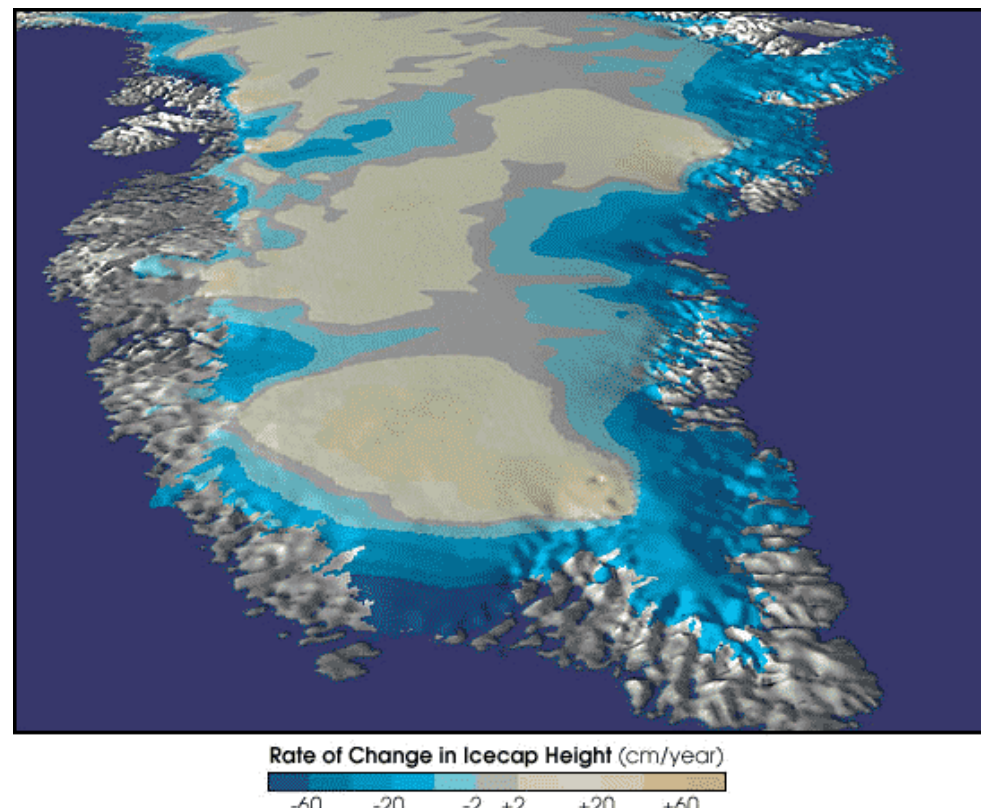
The Iceland scallop (*Chlamys islandica*) is a bivalve mollusc with a lifespan of up to 21 years, which lives in the NW Atlantic at 10–100 m depth.

Shells were kept in a suspended culture at 15 m depth in Kobbefjord near Nuuk (SW Greenland). During a period of 17 months shell growth, temperature, salinity and photosynthetic pigment concentrations were monitored.

The top valve of each shell was embedded in epoxy resin. Thick sections were cut and analysed for various trace and minor elements using laser ablation ICP-MS. Oxygen isotope analyses were done by IRMS.

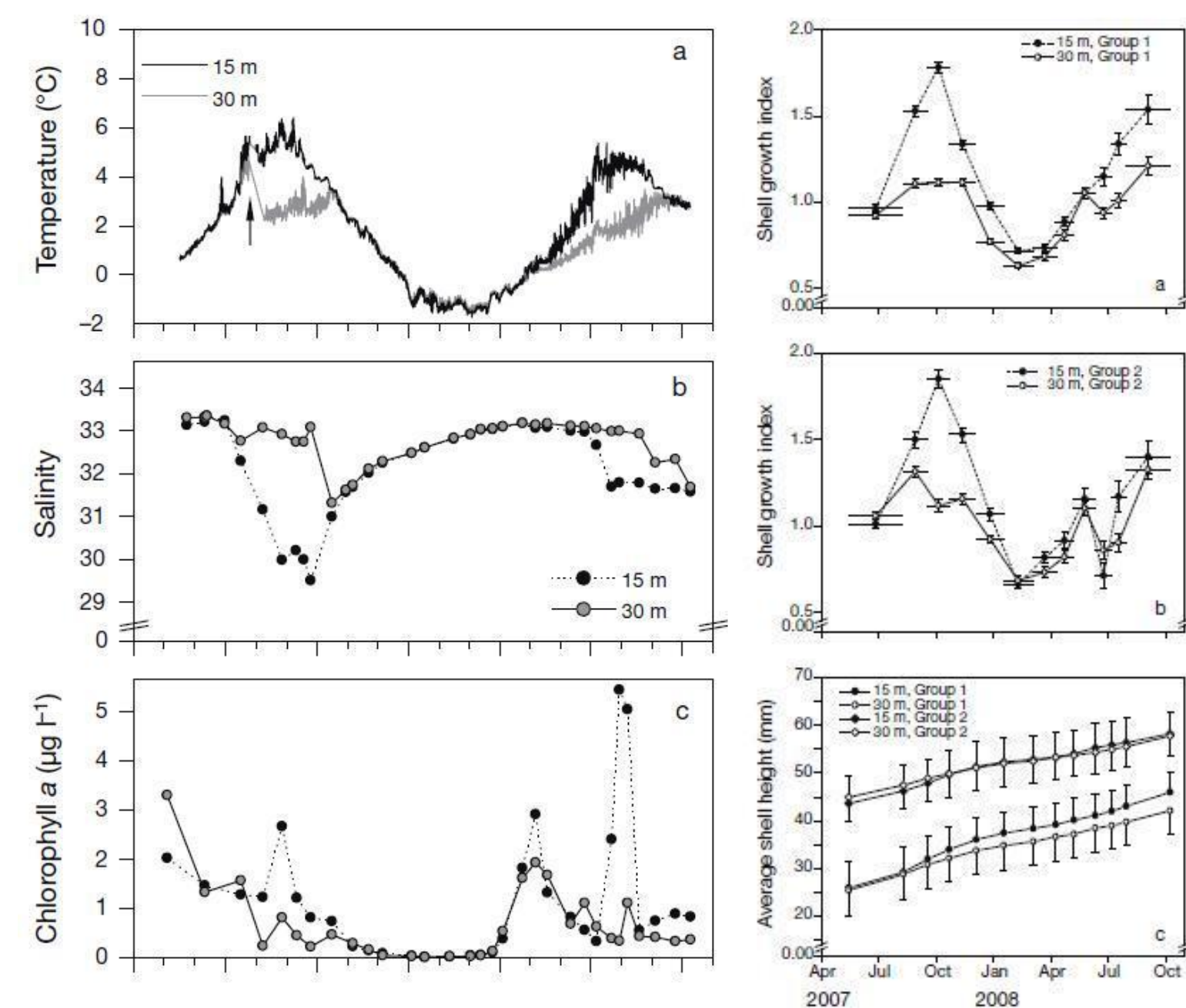
Future work

- Oxygen isotope ($\delta^{18}\text{O}$) values of the entire monitoring period are likely to give insight in meltwater runoff, because of the dramatically different $\delta^{18}\text{O}$ values of seawater and freshwater.
- Analysis of fossil *C. islandica* can give insight in past phytoplankton blooms and probably the behaviour of the Greenland Ice Sheet during different Holocene climate intervals.
- Of special interest are the climatic circumstances accompanying the rise and demise of Greenland cultures, such as the Norse settlement period during the Medieval Warm Period.



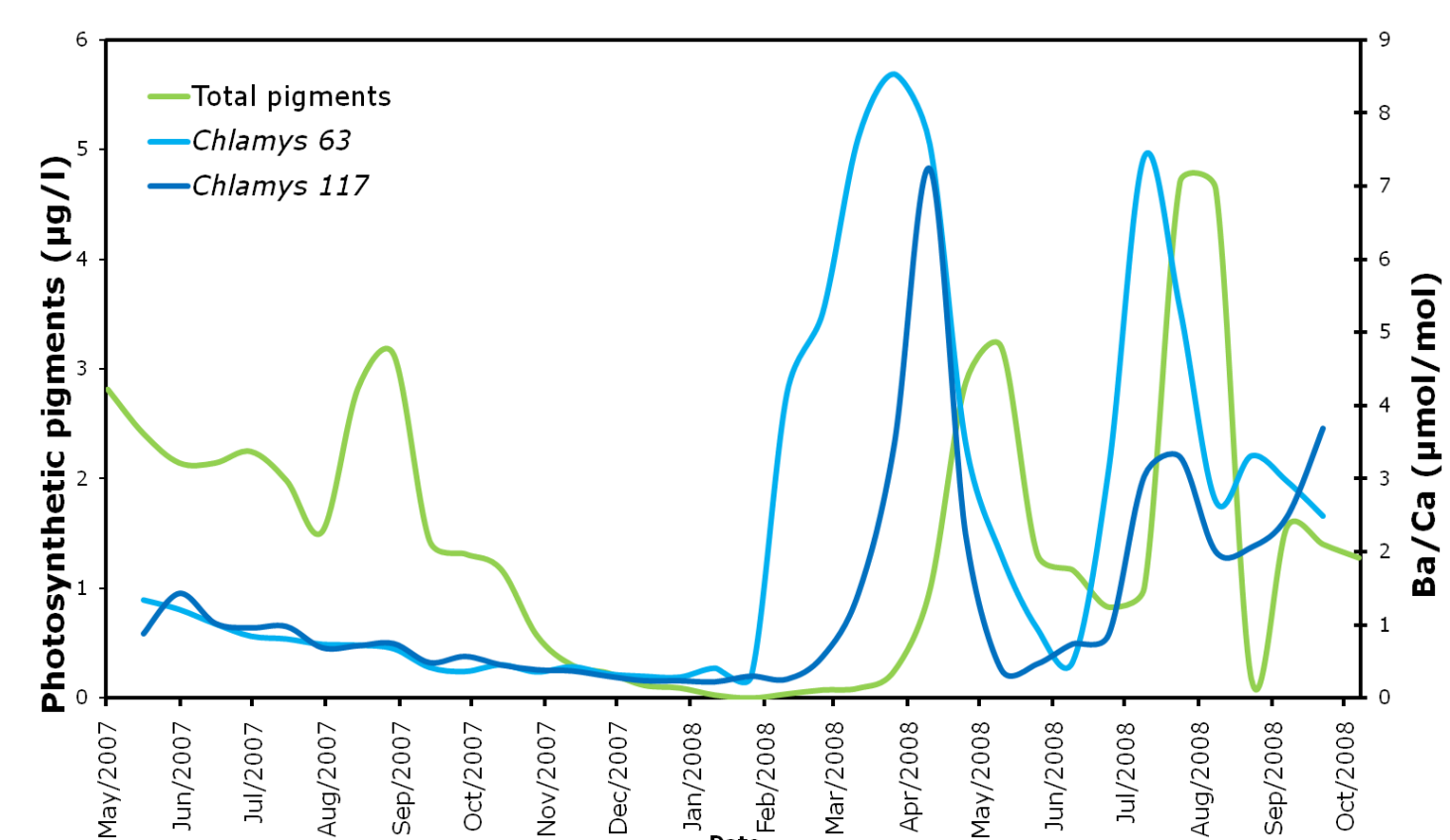
Results & conclusions

Blicher et al. (2010) show that growth of *C. islandica* is strongly influenced by chlorophyll *a* concentration and temperature.



Preliminary oxygen isotope ($\delta^{18}\text{O}$) data point towards equilibrium between the shell and the ambient water.

No relationship was found between Mg/Ca and water temperature, Sr/Ca or B/Ca and salinity or between any other elements analysed and the environmental variables measured.



Barium/calcium composition of the shells appears to be related to phytoplankton blooms (food).

However, the photosynthetic pigments peaks appear to lag the Ba/Ca peaks. This might be an artefact of the conversion of the shell growth axis into a time axis.

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References

1. Blicher, M.E., S. Rysgaard, M.K. Sej, 'Seasonal growth variation in *Chlamys islandica* (Bivalvia) from sub-Arctic Greenland is linked to food availability and temperature', *Marine Ecology Progress Series*, Vol. 407, pp. 71-86