Dinoflagellate cyst based pCO_2 proxy: first results and outlook

JOOST FRIELING[1], GERT-JAN REICHART[1,2], LINDA VAN ROIJ[1], DEDMER B. VAN DE WAAL[3], APPY SLUIJS[1]

[1]Department of Earth Sciences, Utrecht University, Netherlands
[2]Royal Netherlands Institute for Sea Research (NIOZ) Texel, Netherlands
[3]Netherlands Institute of Ecology (NIOO-KNAW), Wageningen, Netherlands

Coupled reconstructions of past temperature and pCO_2 are needed to resolve past climate sensitivity and thereby help to refine climate model predictions for the near future and coming centuries. Unfortunately, most existing proxies for past pCO_2 are lacking the accuracy and precision needed to made robust reconstructions.

In recent years, significant progress has been made towards a pCO_2 proxy based on the carbon isotope fractionation (εp) of dinoflagellate cysts (dinocyst). A strong correlation between εp and pCO_2 was found in culture experiments with various dinoflagellates, including in two species that build the dinocysts *Operculodinium centrocarpum* and *Spiniferites ramosus*. These species are virtually unchanged for >60 Myr and hence potentially represent an opportunity to reconstruct pCO_2 in geological deep time. A recently developed laser-ablation nano-combustion isotope ratio mass spectrometry (LA-nC-IRMS) method allows for accurate analyses of the carbon isotope composition of single dinocysts ($\delta^{13}C_{DINOCYST}$).

Before application of the cyst-based proxy, however, fundamental knowledge is required about, e.g., the relation between the $\delta^{13}C$ of the free-living organism and it's dinocyst, if and how sensitive dinocyst εp is to pCO_2 and environmental parameters other than pCO_2.

We will present the first results of single-species dinocyst carbon isotope fractionation in their natural environment using core-top sediments and sediment core material that covers the last few centuries and the last deglaciation and Holocene. We compare these results with existing instrumental, historical and proxy data. Our findings are placed context of future application of the pCO_2 proxy and how the dinocyst-based pCO_2 proxy could be further developed.