O23

NEW PROXIES FOR PALEOSALINITY BASED ON STABLE HYDROGEN ISOTOPIC COMPOSITION OF ALGAL BIOMARKERS

Marcel van der MEER[1], Marianne BAAS[1], Irene RIJPSTRA[1], Gianluca MARINO[2], Eelco ROHLING[3], Jaap SINNINGHE DAMSTÉ[1] and Stefan SCHOUTEN[1]

1. *Royal Netherlands Institute for Sea Research, Marine Biogeochemistry and Toxicology, P.O. box 59,1790 AB Den Burg (Texel), The Netherlands*
2. *Department of Earth Sciences - Geochemistry, Faculty of Geosciences, Utrecht University, P.O. Box 80.021, 3508 TA Utrecht, The Netherlands*
3. *School of Ocean and Earth Science, Southampton University, National Oceanography Centre, Southampton SO14 3ZH, United Kingdom*

Testing climate models for future climate change critically depend on our ability to quantitatively reconstruct past climate. Paleosalinity is the single most important oceanographic parameter which currently can still not be accurately quantified from sedimentary records. To date, the most promising tool to estimate paleosalinity variations combines reconstructions of paleotemperature and foraminiferal $\delta^{18}O$. Foraminiferal $\delta^{18}O$ varies as a function of temperature and ambient seawater $\delta^{18}O$ which is directly coupled to seawater salinity. The close relation between the stable hydrogen isotope ^{2}H (deuterium, *D*) and $\delta^{18}O$ in precipitation and seawater (so-called meteoric water line) enables an alternative approach to deconvolve palaeosalinity. Deuterium is incorporated into marine organic matter during photosynthesis and can be extracted from seafloor sediments (e.g. Krishnamurthy et al., 2000). Thus, δD analyses on marine organic matter could provide an alternative proxy for seawater palaeosalinity. Recently, we found a strong correlation between salinity and the hydrogen isotopic fractionation of C_{37} alkenones versus water in cultures of *Emiliania huxleyi* and *Gephyrocapsa oceanica*, although growth rate also had some impact (Schouten et al., 2006). This suggest that δD of alkenones can be used to reconstruct past salinities if growth rate and δD_{water} can be constrained.

We applied this newly developed proxy in a core covering the last 3000 yrs of the Black Sea. Approximately 2700 yrs ago *E. huxleyi* invaded the Black Sea, illustrated by the deposition of a coccolith ooze from this time on. Because *E. huxleyi* has never been observed at salinities below 11 practical salinity units (PSU), a salinity increase to above 11 PSU has been suggested for that time period (Hay, 1988). Our results show that the δD values of alkenones gradually decreased over the last 3000 yrs suggesting a decrease in salinity and, therefore, a higher than present day salinity 2700 yrs ago. This makes it likely that the invasion of the Black Sea by *E. huxleyi* is not caused by an increase in salinity. We also analyzed the hydrogen isotopic composition of C_{37} alkenones in the S5 sapropel from an Aegean Sea core. Sapropels are thought to be formed after a massive freshwater flooding of

the Eastern Mediterranean from the African continent. Our results show that simultaneous with sapropel deposition and prior to the development of photic zone euxinia there was a large decrease in salinity of up to 6 PSU (Fig.1), in good agreement with modeling results. These results show that δD of alkenones is a promising new tool for reconstructing past salinities and another tool for reconstructing paleo-environments using alkenones in addition to the widely applied U^{K}_{37} palaeothermometer.

We are currently examining the hydrogen isotopic fractionation patterns of other algae known to produce specific biomarkers, i.e. long-chain diols from *Proboscia* diatoms and dinosterol from dinoflagellates. The results will reveal if, besides alkenones, other algal biomarkers can also be used to trace past fluctuations in salinity.

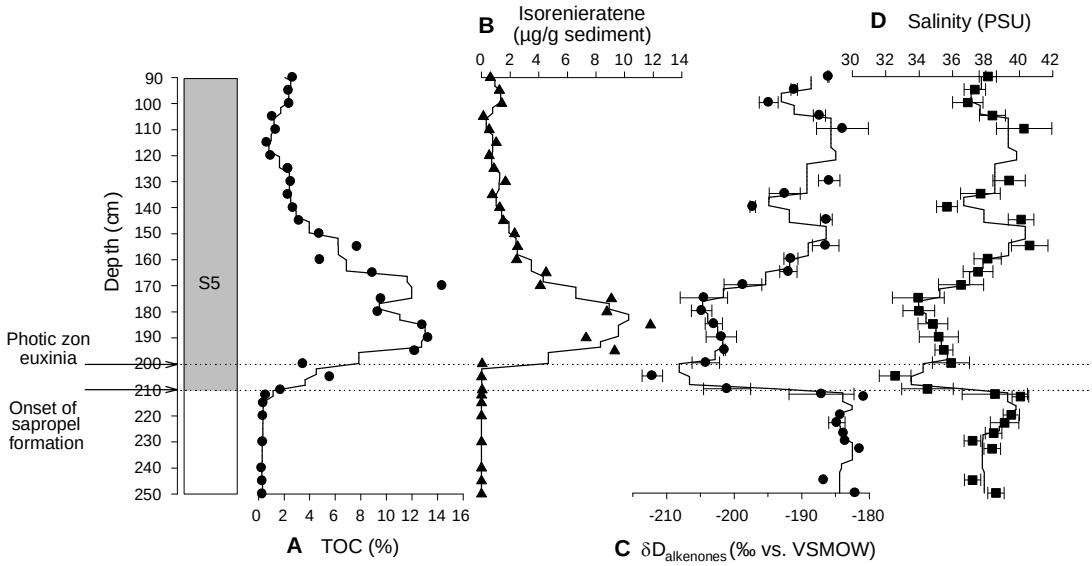

Figure 1. Stratigraphic record of sapropel S5 of (A) TOC in %, (B) isorenieratene in µg/g sediment, (C) $\delta D_{\text{alkenones}}$ in ‰ vs. VSMOW and (D) estimated salinities in PSU.

REFERENCES

Hay, B.J. (1988) Sediment accumulation in the central western Black Sea over the past 5100 years. *Paleoceanography* **3** 491-508.

Krishnamurthy, R.V., Meyers, P.A. and Lovan, N.A. (2000) Isotopic evidence of sea-surface freshening, enhanced productivity, and improved organic matter preservation during sapropel deposition in the Tyrrhenian Sea. *Geology* **28** 263-266.

Schouten, S., Ossebaar, J., Schreiber, K., Kienhuis, M.V.M., Langer, G., Benthien, A. and Bijma, J. (2006) The effect of temperature, salinity and growth rate on the stable hydrogen isotopic composition of long chain alkenones produced by *Emiliania huxleyi* and *Gephyrocapsa oceanica*. *Biogeosciences* **3** 113-119.