New approaches to assess the responses of phytoplankton to ocean acidification

BJÖRN ROST

Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany (Bjoern.Rost@awi.de)

Global Change will affect phytoplankton in many ways, altering the complex balance of biogeochemical cycles and climate feedback mechanisms. Hence, predictions of how phytoplankton may respond to these perturbations at the cellular and ecosystem levels are a major challenge in global change research. In this presentation, I will outline the expected physico-chemical changes in the marine environment (e.g. ocean acidification, light regime, nutrients supply) and describe how these may affect different phytoplankton groups. Focusing on coccolithophores, diatoms, dinoflagellates and cyanobacteria, results from laboratory and field studies will be analyzed in view of the overall sensitivity (e.g. elemental composition, growth rate, productivity) to ocean acidification. To go beyond this descriptive level, methods on cellular processes are increasingly applied in the context of global change research. They yield information about underlying mechanisms causing processes like photosynthesis, calcification or N_2 fixation to be responsive to ocean acidification.

Overall results indicate major species- and taxa-specific differences in the sensitivity towards ocean acidification. While some species are not responsive at all, others will clearly benefit or have to face detrimental effects. The presented data will stress, however, that responses to ocean acidification are strongly modulated by other environmental conditions, such as light or nutrient levels. As these factors are also influenced in the framework of global change, the combined effects have to be considered. Some of the observed responses can meanwhile be related to species- or taxa-specific physiological traits. Next to *direct* CO_2 effects (e.g. on processes like the CO_2 concentrating mechanism), the aspect of energy allocation between physiological processes seems to play an crucial role in causing *indirect* CO_2 effects (e.g. on processes like N_2 fixation). As the cellular changes imposed by ocean acidification likely influence the competitive abilities of species, implications for the natural phytoplankton communities and biogeochemical cycling may be even be larger than indicated from results obtained in mono-specific incubations.

Wetland extension on the Russian Plain over the past 40 kyr: A biomarker approach from the Black Sea

F. ROSTEK* AND E. BARD

CEREGE, Univ. Aix-Marseille, CNRS, IRD & College de France, Technopole de l'Arbois BP 80 13545 Aix-en-Provence Cedex 04, France
(*correspondence: rostek@cerege.fr, bard@cerege.fr)

The Black Sea is a catchment basin for large areas of the European Russian Plain, the Alps and southeastern Europe. In order to study the hydrological changes in this basin over the last 40 kyr, we measured a continous series of terrestrial long-chain *n*-alkan-2-ones and *n*-alkanes as paleoclimate proxies in well dated glacial lacustrine to Holocene marine sediments from the NW Black Sea.

Two specific molecules of these homologuous series are normalized to total organic carbon (TOC), respectively Ket27/TOC for *n*-alkan-2-ones and C23/TOC for n-alkanes and interpreted as characteristic biomarkers for *Sphagnum* mosses, a dominant vegetation component in wetlands. Decreased concentrations of *Sphagnum* biomarkers are found for the North Atlantic icebergs surges and cooling events known as Heinrich Events, the Last Glacial Maximum and the Younger Dryas. These drops are pointing to low erosional input to the Black Sea with cold and dry climate conditions. Increased biomarker inputs characterize the mild climate phases known as Dansgaard/Oeschger Interstadials, pointing to increased erosion due to permafrost degradation and/or wetland extension on the Russian Plain.

The final retreat of the Fennoscandian ice sheet is concomitant with Heinrich Event 1 and expressed by increased biomarker concentrations in the so-called Red Layers, a typical series of deglacial clay layers. The two biomarker signals are decoupled at the start of the Bølling/Allerød: C23/TOC is decreasing whereas Ket27/TOC variations are in phase with the major climate events like the Bølling/Allerød, the Younger Dryas event and the early Holocene. The paleoclimatic record is interrupted by the final reconnection of the Black Sea with the Mediterranean Sea which led to marine conditions.