Geophysical Research Abstracts
Vol. 18, EGU2016-933-1, 2016
EGU General Assembly 2016

Environmental control on *Emiliania huxleyi* coccolithophore calcification in the Mediterranean Sea

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The Mediterranean Sea, a "natural laboratory" characterized by strong environmental gradients, is likely to undergo serious alterations due to climate change and ocean acidification. These processes are expected to affect also phytoplankton distribution. Coccolithophores are the only phytoplankton calcifying group and laboratory studies on *E. huxleyi*, the most abundant and widely distributed species of coccolithophores worldwide, yield strain-specific results. Culture experiments must be integrated with observations in the natural environment to understand existing interactions between drivers, and to verify population structures in different areas.

Two transects spanning the south-western and south-eastern basins have been investigated, combining data from April 2011 (Meteor cruise M84/3) and May 2013 (MedSeA cruise). *E. huxleyi* coccolith morphometry was analyzed to determine average mass and length. These results were then compared with morphological observations performed on the largely dominant *E. huxleyi* Type A through scanning electron microscope (SEM).

We distinguished four main calcification morphologies within *E. huxleyi* Type A: low-calcified (A1), medium-calcified (A2), high-calcified with closed central area (A3a), and open central area (A3b). *E. huxleyi* coccolith mass was strongly and positively correlated with the relative abundance of a particular morphology. Moreover, the calcification morphologies were preferentially distributed in the Mediterranean according to specific combinations of environmental variables, which included the carbonate chemistry system.

The distribution of *E. huxleyi* Type A calcification morphologies in the Mediterranean is likely to be influenced by climate changes. Coccolithophore calcification degree is connected to the carbon cycle through photosynthesis / calcification ratio and sedimentation (particulate inorganic and organic carbon reaching the seafloor). This study aims to provide a basis for future investigations on the relationships between climate and calcifying phytoplankton. The Mediterranean is a marginal sea; nevertheless our results could be applicable to other regions and reflect ecological mechanisms taking place also in the open ocean.