Strategic Workshop on Ocean Acidification
Meloneras, Gran Canaria, 28-30 January 2008

The likely impact of ocean acidification in the Mediterranean

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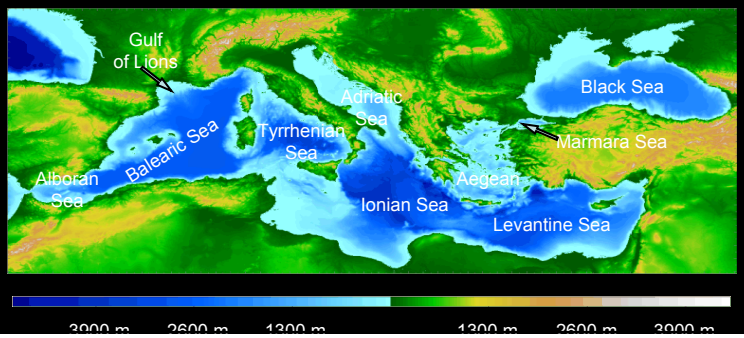
Acknowledgments:

Sebastian Meier
Catherine Goyet
Daniela Turk
Dror Angel
Marcello Vichi



source: www.unipv.it/webcib/edu_Mediterraneo_uk.html

The likely impact of ocean acidification in the Mediterranean

- Mediterranean oceanography and what is known on the carbonate system in the Mediterranean Sea?
- Past changes
- Main questions for future impacts

ESF- EuroCLIMATE Workshop

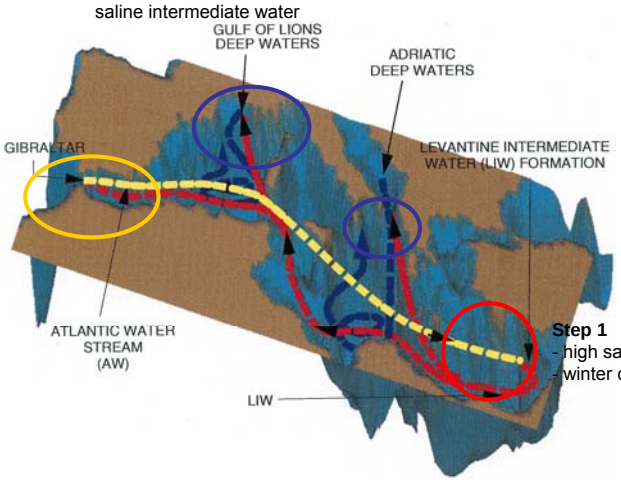
Atmospheric CO2, ocean acidification, and ecological changes in planktonic calcifying organisms

www.esf.org/acidification-workshop.html

Mediterrananean oceanography

Thermohaline circulation in the Mediterranean

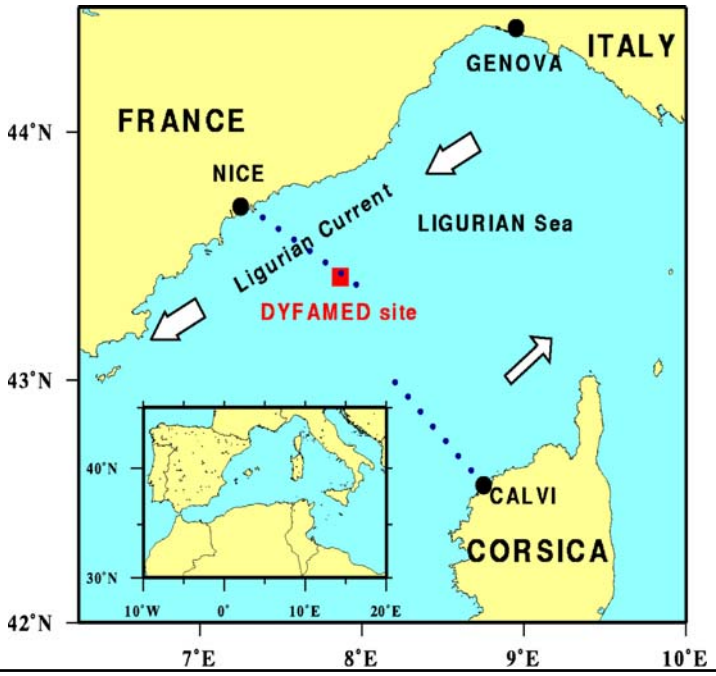
Step 2
- relatively low saline surface water is cooled down and sinks
- mixes with relatively warm and saline intermediate water



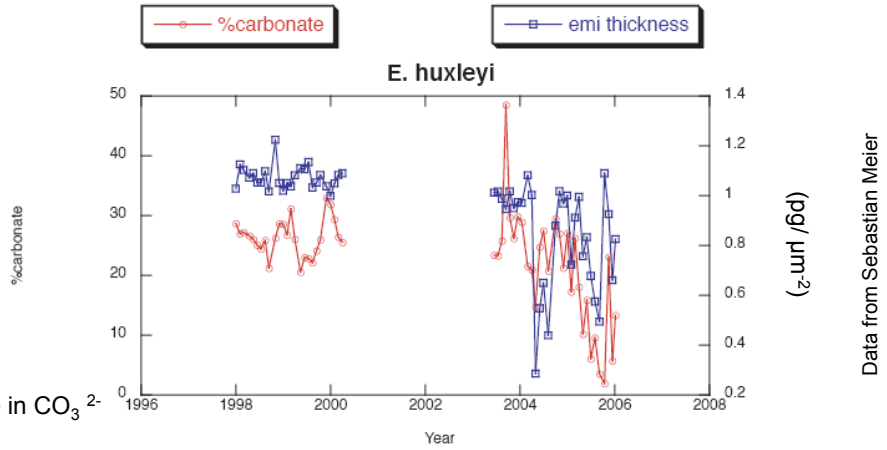
Step 1
- high salinity through evaporation
- winter cooling

from Pinardi und Masetti 2000

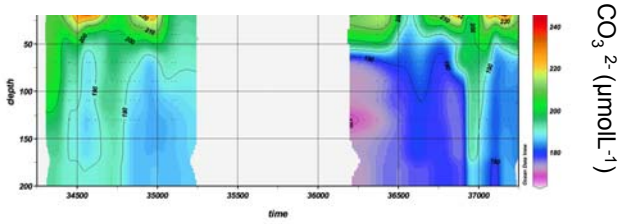
DYFAMED time serie



DYFAMED time serie

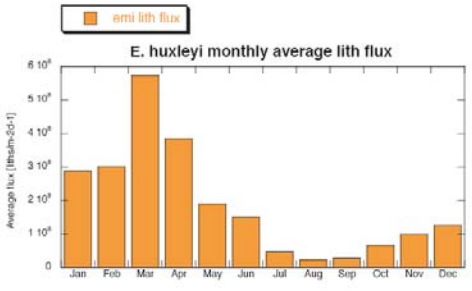


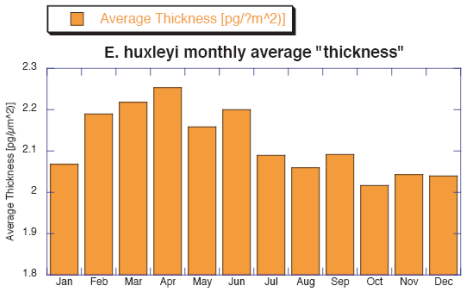
decline in CO_3^{2-} in the lower photic zone and decline in *Emiliania huxleyi* weight



DYFAMED time serie

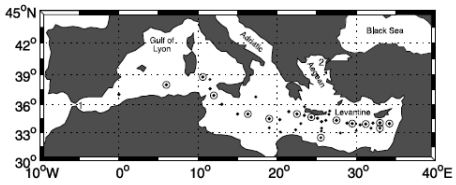
production and calcite thickness

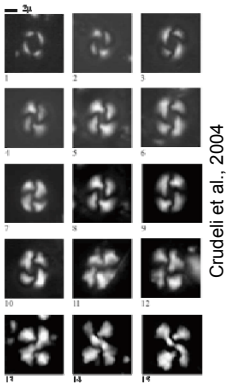




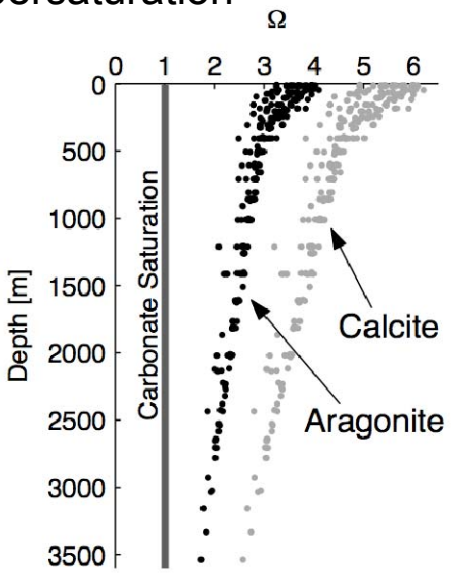
Mediterrananean Carbonate System

$CaCO_3$ supersaturation





Emiliania huxleyi calcification



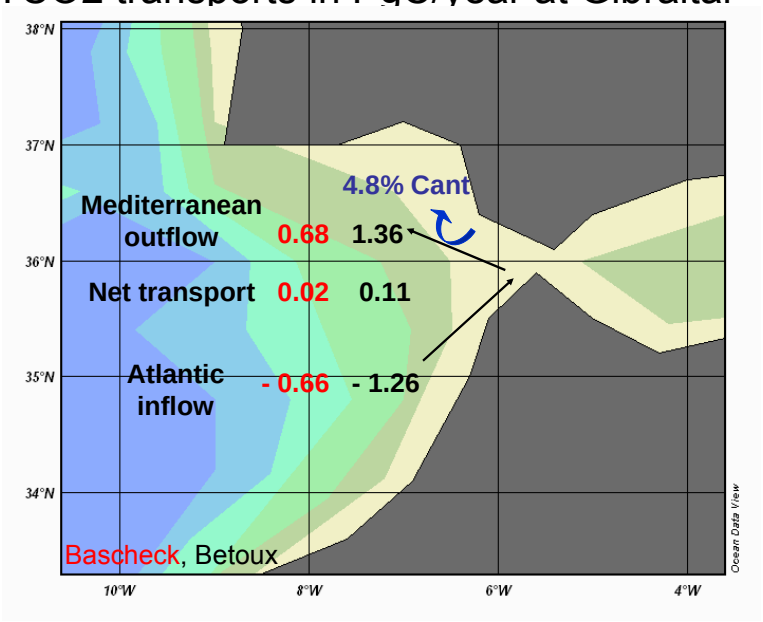
Schneider et al. 2007

Mediterrananean Carbonate System

- *rivers and Black Sea as alkalinity sources*
- *transport to the deep ocean in coastal regions*
- *if in steady state, long term net sources of alkalinity must equal long term net sinks*
- *export through the street of Gibraltar is small*
- *CaCO3 production as a possible sink*
- *supported by carbonate system variables?*

Mediterrananean Carbonate System

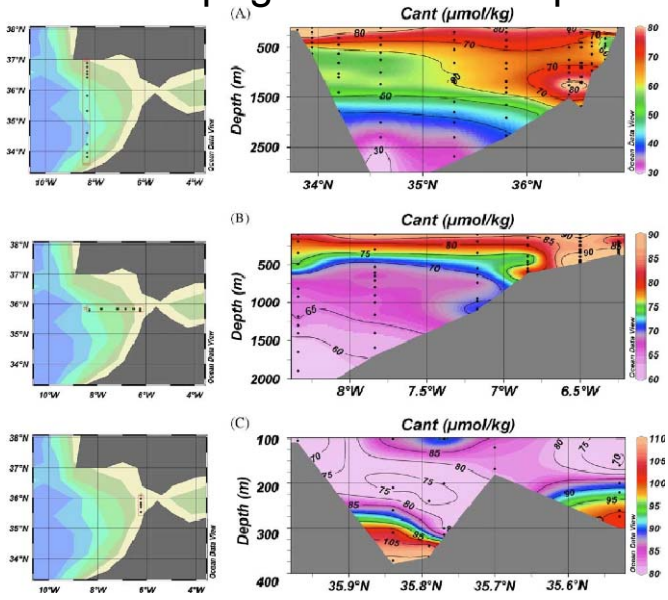
TCO2 transports in PgC/year at Gibraltar



from Aït-Ameur & Goyet 2006

Mediterrananean Carbonate System

Anthropogenic carbon export from the MED



- Atlantic inflow F_{TCO2} 0.66-1.31 Pg C y^{-1}
- Med outflow F_{TCO2} 0.68-1.38 Pg C y^{-1} with 4.8% C_{ant}
- net F_{TCO2} 0.02-0.07 Pg C y^{-1}

from Aït-Ameur & Goyet 2006

Available online at www.sciencedirect.com
ScienceDirect
Progress in Oceanography

Transient Eastern Mediterranean deep waters in response to the massive dense-water output of the Aegean Sea in the 1990s

Wolfgang Roether [a,*], Birgit Klein [a,1], Beniamino Bruno Manca [b], Alexander Theocharis [c], Sotiris Kioroglou [c]

DEEP-SEA RESEARCH Part I

Large warming and salinification of the Mediterranean outflow due to changes in its composition

Claude Millot[a,*], Julio Candela[b], Jean-Luc Fuda[c], Youssef Tber[d]

- Deep water formation changed from the Adriatic to the Aegean
- Formation of extremely dense water mass
- This affected Western Mediterranean Oceanography
- Composition of Mediterranean Outflow Water that enters the Atlantic Ocean has changed

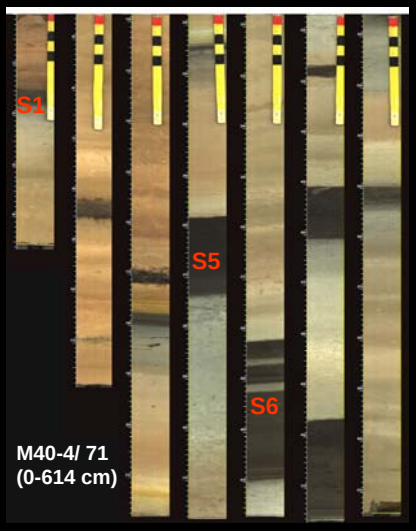
EuroCLIMATE
A EUROCORES PROGRAMME
EUROPEAN SCIENCE FOUNDATION COLLABORATIVE RESEARCH

A new multi-proxy palaeo-climatic approach to unravel marine productivity during sapropel deposition: clues from coccolithophorids and organic geochemistry

MERF
Marine
Ecosystem
Response
to
Fertilisation

MERF

Quaternary **M**arine **E**cosystem **R**esponse to **F**ertilization:
Mediterranean sapropel events and implications for marine carbon uptake



http://www.gpi.uni-kiel.de/~sm/Meier/MERF.html

- increased production and preservation of C_{org}
- increased efficiency of biological pump?
- lighter coccoliths
- decreased efficiency of carbonate pump?
- net effect depends on balance between increased productivity and decreased $CaCO_3$ production per coccolith

- What will be the response of the Mediterranean ecosystem (carbonate and non-carbonate) to OA?
- At which pace, which amplitude?
- What is the global impact?
- What will be the response of calcifying and non calcifying organisms?
- What impact will changes in the carbonate system have compared to other environmental changes?
- Long term continuous monitoring!
- Field experiments.