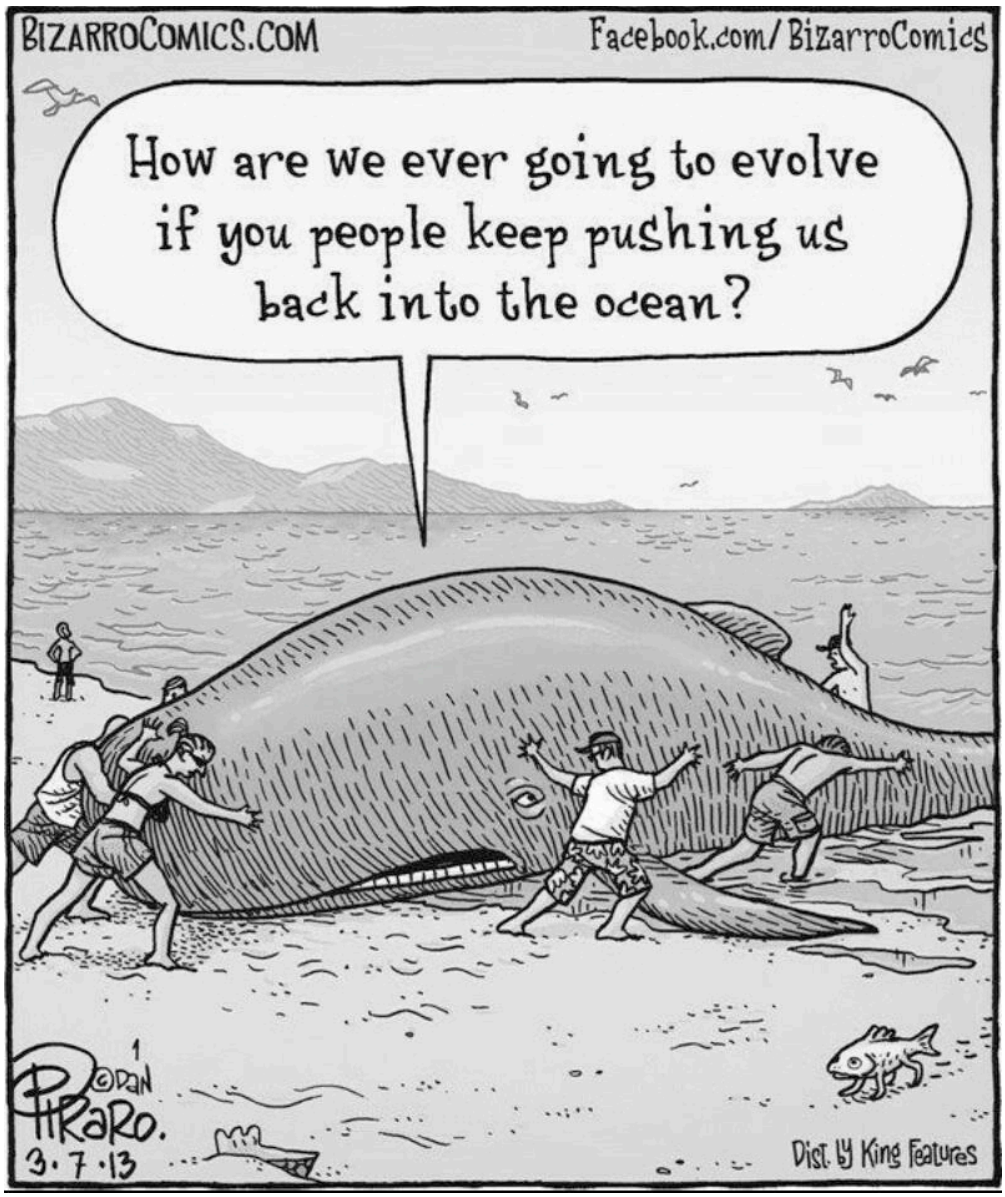
Tentamen Marine Sciences 3

29 January 2015



NB1: Schrijf uw naam en studentnummer op *ieder* in te leveren blad
NB2: Maak uw antwoorden compleet maar vooral ook zo kort/to the point mogelijk; *gezwets levert geen punten op*
NB3: Schrijf netjes: slecht leesbaar voor de docent is fout
NB4: Vergeet de digitale enquête niet in te vullen!

Succes!

Namens alle docenten, Appy

Naam: ***Studentnummer:***

Francesca Sangiorgi

1. In future oceans, the hypoxic zones of the open ocean may meet the hypoxic zones of the coastal sea.

a. What could be the cause of the hypoxia in these two zones?

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b. Where in the world ocean could this theoretically happen?

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2. Complete the table: put an X in the cells for the correct combination(s) of group of phytoplankton and wall composition, and write a H (high), L (low) or HL (both high and low) in the cells for affinity with nutrients and turbulence

	Siliceous wall	Calcareous wall	Organic wall	Nutrients (H or L)	Turbulence (H or L)
Diatoms					
Dinoflagellates					
Coccolithophores					

Naam: ***Studentnummer:***

3. Choose your favorite phytoplankton group (diatoms, dinoflagellates or coccolithophores) and briefly explain potential advantages and disadvantage it will encounter in a future ocean with high T and CO_2, and low O_2

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Naam: ***Studentnummer:***

Dedmer van de Waal

1. Explain how the growth of a non-calcifying phytoplankton species will affect **a**) pH, **b**) alkalinity, and **c**) the CO_2 concentration in the water (assuming growth on nitrate as nitrogen source and in a closed system).

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2. Give two examples of how global change could affect the carbon:nutrient stoichiometry of phytoplankton.

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3. Explain why phytoplankton need a carbon concentrating mechanism.

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Naam: ***Studentnummer:***

Corina Brussaard

1. Describe the two major life cycles of viruses in the ocean and explain how they relate to the trophic status of pelagic ecosystems.

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2. Grazing may increase species diversity but may also decrease it – provide examples for both situations and explain why.

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3. Global climate change-induced warming of the surface ocean results in physicochemical (physics and chemistry) changes and has biological consequences.

a. Describe how these changes will affect the length of the food chain in the temperate Northeast Atlantic Ocean, and explain why.

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b. Will this stimulate the biological pump? Explain.

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Naam: ***Studentnummer:***

Sabine Gollner

1. Many deep-sea animals on abyssal plains are smaller than their shallow water relatives, whilst some others are much larger. Food availability is a key factor.

a. Is productivity high or low on deep-sea abyssal plains and why?

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b. What are the advantages of dwarfism and gigantism?

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2. Deep-sea hydrothermal vent macrofauna communities are typically species-poor but high in abundance and biomass.

a. What abiotic factors select for a small number of species?

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b. Is primary production at vents high or low and why?

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Naam: ***Studentnummer:***

Mark Vermeij

1. Name three factors that explain the occurrence of coral reefs on a global scale.

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2. Draw a diagram illustrating the "relative dominance model". Include the various algal communities and the two factors that are believed to be primarily responsible for the differences in algal community structure.

3. On a small island surrounded by reefs, heavy fishing occurs. After some time, researchers observe an increase in microbes in the water column. Explain

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Naam: ***Studentnummer:***

Gert-Jan Reichart en Lennart de Nooijer

1. The skeletons (tests) of foraminifera are often used as proxies to reconstruct past environments. What makes foraminifera such popular and useful proxies?

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2. Give 3 examples of proxies based on foraminifera, explain the fundamental principles on which these proxies are based and what you can reconstruct with them?

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3. Calcification by foraminifera is influenced by the presence of Mg ions in seawater. How did the ratio of seawater $[Mg^{2+}]/[Ca^{2+}]$ and changes therein affect foraminiferal calcification over the last ~500 million years?

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Naam: ***Studentnummer:***

Appy Sluijs

1. Figure 1 shows a compilation of data generated on ocean drilling program sites from various ocean basins and an outcrop.

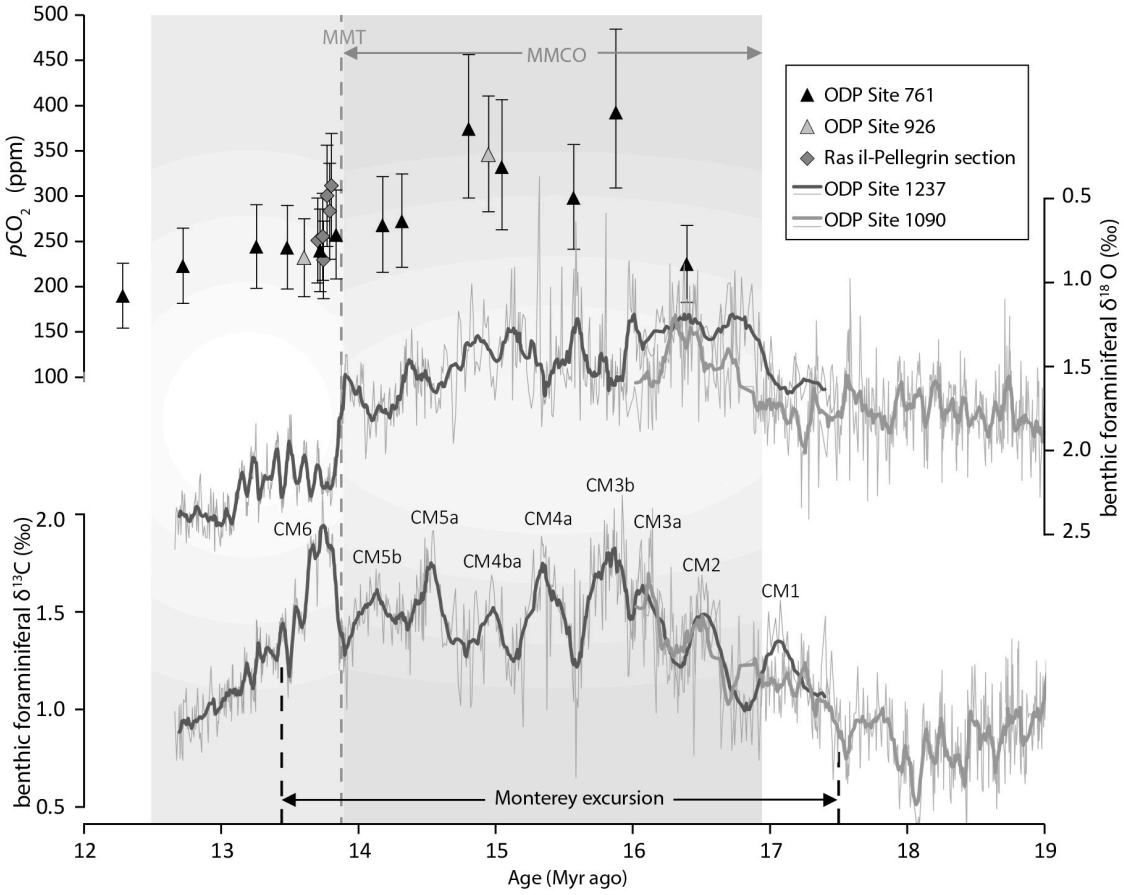

Figure. 1. Reconstructions of pCO_2 based on several proxies, and benthic foraminifer stable carbon and oxygen isotope records across the middle Miocene climatic optimum (MMCO; ~17-14 million years ago) and Mid-Miocene Transition (MMT; ~14 million years ago).

a. The onset of the MMCO is associated with a decrease in benthic foraminifer $\delta^{18}O$. Which two factors could have caused this shift? Briefly explain both factors.

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b. The MMCO records an increase in the $\delta^{13}C$ of benthic foraminifera in the Pacific and Atlantic Oceans (Monterey excursion). Early papers hypothesized that this increase related to the simultaneous deposition of organic carbon-rich sediments in California (near Monterey). Why does this hypothesis make sense?

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c. The very large increase in benthic foraminifer $\delta^{18}O$ during the Mid-Miocene Transition at ~14 million years ago is typically interpreted as a massive expansion of the Antarctic Ice sheet. This likely also resulted in more (seasonal) sea ice cover along the Antarctic margins. Name 2 biological changes you expect to record in the sediments along Antarctica.

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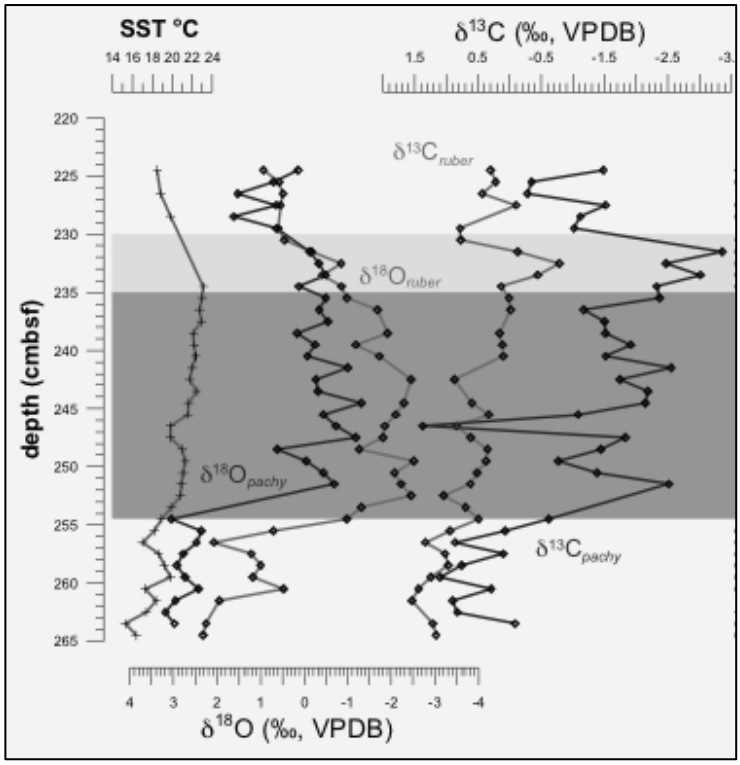
Naam: ***Studentnummer:***

Francesca Sangiorgi

1. The following plot comes from the analysis of one core located in the open Eastern Mediterranean and containing sapropel S5 (~ 125,000 years BP).



a. Why do the $\delta^{18}O$ of *G. ruber* and *N. pachyderma* both shift towards lower values in the sapropel?

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b. Why is the $\delta^{18}O$ of *G. ruber* more negative than the $\delta^{18}O$ of *N. pachyderma?*

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c. Why do the $\delta^{13}C$ of *G. ruber* and *N. pachyderma* both shift to lower values with the $\delta^{13}C$ of *N. pachyderma* being much lighter? Why may this trend in the $\delta^{13}C$ seem counterintuitive?

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d. List in a chronological order the climatic and oceanographic causes and consequences which led to sapropel deposition in the Mediterranean Sea

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