EFECTES DE L'ACIDIFICACIÓ OCEANICA SOBRE ELS MICROORGANISMES MARINS

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Treball de fi de grau -- Biologia

Ocean acidification Vs. calcifying organisms

$\uparrow CO_2 + H_2O \leftrightarrow H^+ + HCO_3^- \leftrightarrow 2H^+ + CO_3^{-2}$

Acidification

$\downarrow pH$

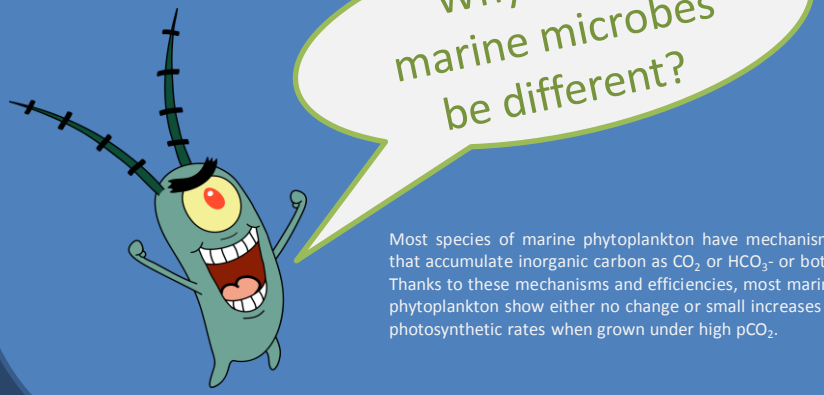
$CO_3^{-2} + Ca \leftrightarrow \downarrow CaCO_3$

Tampon effect

Microbes are the most important organisms in the sea. In contrast to the land, where plants are large and long-lived, in the seas most of the primary production comes from microscopic algae, or phytoplankton. These have tiny biomass and their generations last only days. The productivity of this phytoplankton depends in turn on bacteria and archaea to regenerate nutrients. They also control biogeochemical cycles and keep the planet habitable.

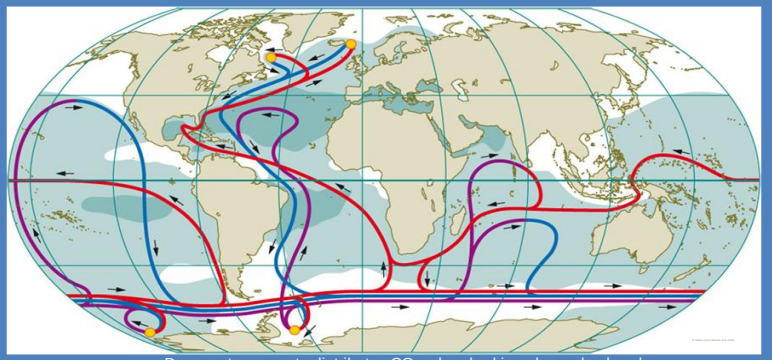
Knowledge on microorganism-mediated processes that may be susceptible to Ocean Acidification is difficult to achieve since every process is intrinsically related to others.

Freshwater lakes have significant daily variations in pH as a result of normal temporal phasing of net photosynthesis and net respiration that can be as much as 2–3 pH units. Yet phytoplankton, bacteria, archaea and metazoans are all present in lakes, and appear to be able to accommodate large daily and seasonal changes in pH.



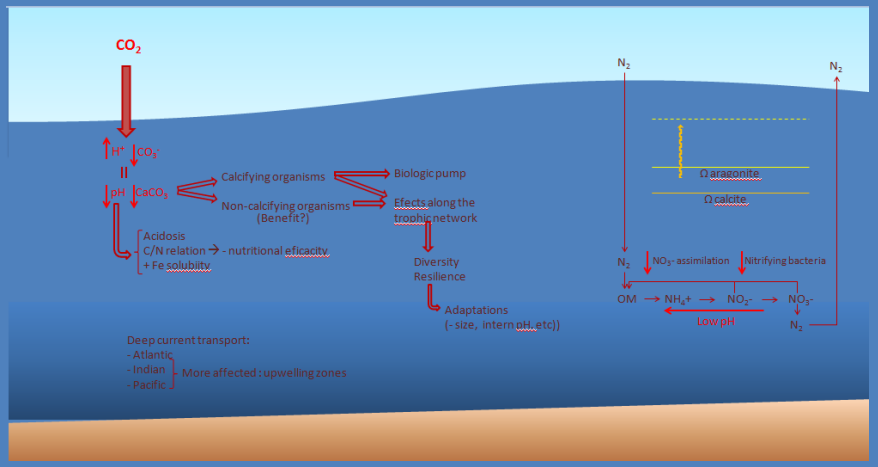
Most species of marine phytoplankton have mechanisms that accumulate inorganic carbon as CO_2 or HCO_3^- or both. Thanks to these mechanisms and efficiencies, most marine phytoplankton show either no change or small increases in photosynthetic rates when grown under high pCO_2.

THERMOHALINE CIRCULATION



Deep water currents distributes CO_2, absorbed in polar and sub-polar regions, to upwelling zones

HOW MARINE MICROBES WOULD RESPOND TO A HIGH-CO_2 WORLD?



CO_2 and pH in the surface ocean are not, and never have been, constant. Given these facts, perhaps the most probable hypothesis is that marine microbes possess the flexibility to accommodate pH change and there will be no catastrophic changes in marine biogeochemical processes driven by phytoplankton, bacteria and archaea.

Calcifying organisms are a special case as carbonate minerals will be less saturated—and for the case of aragonite, undersaturated in surface waters in a high-CO_2 ocean. Photosynthetic organisms may also be influenced and it is even possible that higher CO_2 be beneficial. But the rest of the microbial community should not be assumed to be at risk until evidence to the contrary is obtained.