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THE INTERACTIONS BETWEEN OCEAN AND CLIMATE

6 fact sheets for the general public

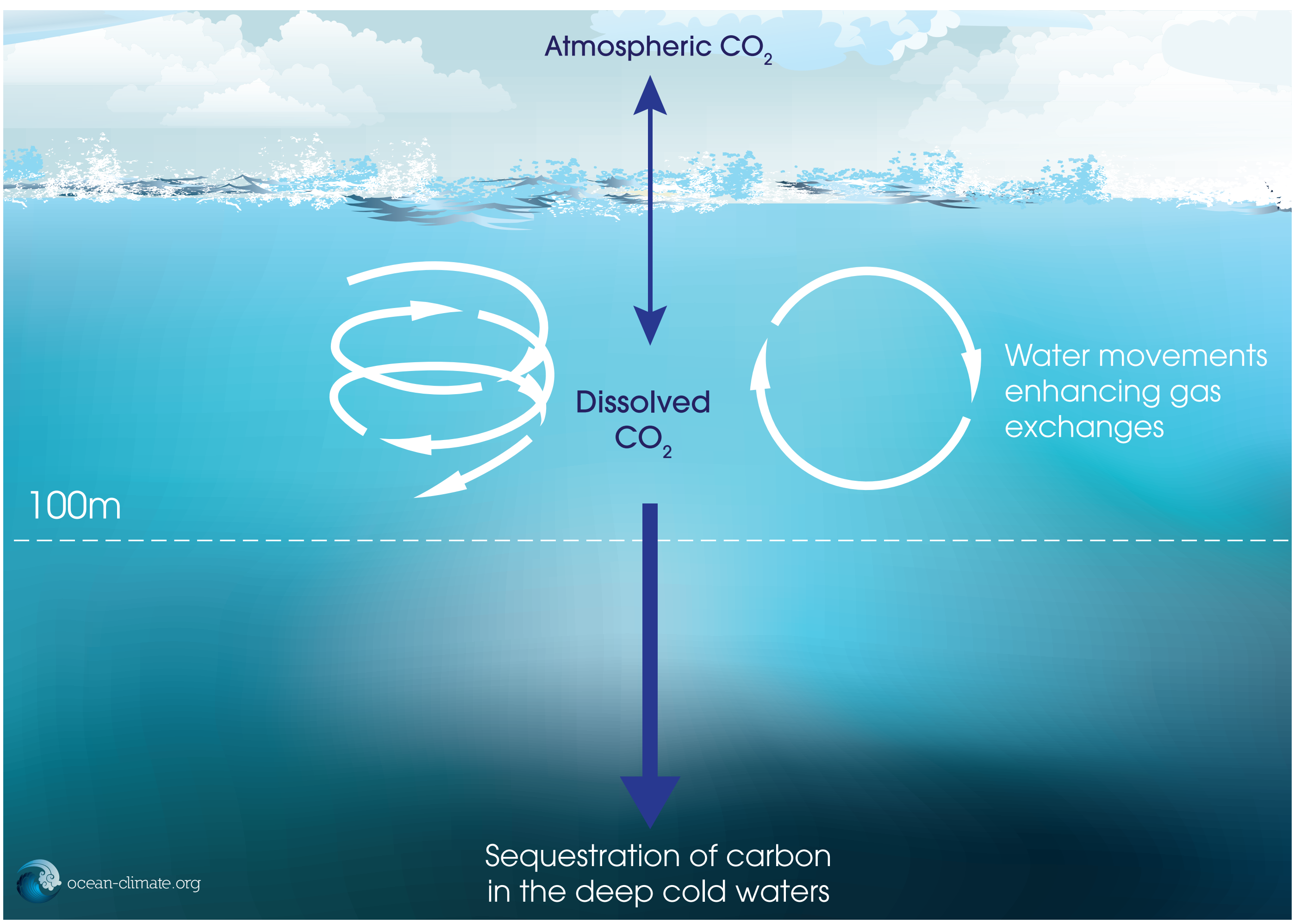
THE OCEAN, ORIGIN OF LIFE ON EARTH (1/2)

As Long as there is Plankton!

The ocean is home to a population called plankton. Invisible to the naked eye, it is formed by microscopic organisms that flow with the ocean currents. It represents more than 95% of marine biomass and includes an extraordinary diversity: viruses, bacteria, microalgae, reproductive cells, fish larvae, micro-crustaceans, etc.

A part of the plankton, phytoplankton, also called microalgae, behaves just like plants: through photosynthesis, it absorbs carbon dioxide and produces more than 50% of the oxygen we breathe.

Two main mechanisms transfer the carbon dioxide (CO_2) from the atmosphere to the ocean. The most important phenomenon is physical: about nine-tenths of atmospheric carbon dioxide is transferred to the ocean by simple dissolution of the gas into surface seawater which is then transported by ocean currents to the deep layers of the ocean.



Physical carbon pump

THE OCEAN, ORIGIN OF LIFE ON EARTH (2/2)

The second mechanism, which represents 10% of the accumulation of carbon in the oceans, is biological: phytoplankton, suspended in the sunlit ocean surface layer, takes part in the carbon cycle by producing organic matter via photosynthesis. This plankton is considered as a "lung" for the planet, comparable to forests on land: indeed it absorbs CO_2 and produces oxygen (O_2). Over geological timescales, photosynthesis has led to the oxygenation of our atmosphere.

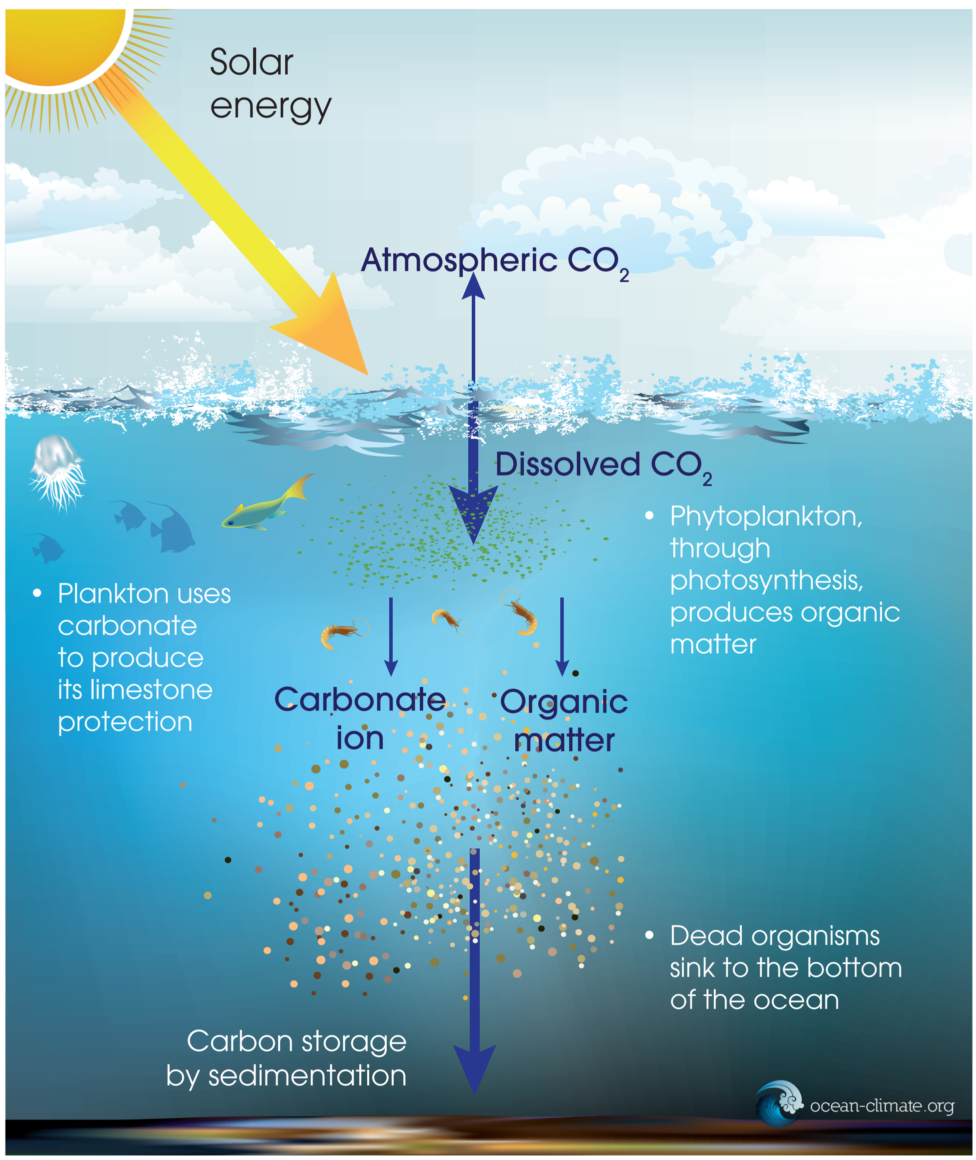
When unconsumed and dead, the plankton sinks to the bottom of the sea where it accumulates, forming thick layers. The carbon-rich organic matter contained in this sediment can eventually evolve into oil or gas.

Phytoplankton species with calcareous shells are also involved in carbon sequestration as they store calcium carbonate ($CaCO_3$) in their shells. These sediments then develop into limestone. The cliffs of Dover are a typical example.

This biodiversity is represented by thousands of species of algae and planktonic animals. It is the first link in the marine food chain and is vital to all fisheries and to the global economy which depends on it. However, knowledge about the global ecosystem is very fragmented. Policy makers and the general public still know very little about the global ecosystem in action, its biological importance and economic value.

The ocean therefore plays a major role in climate regulation as it acts as a carbon pump and source of oxygen thanks to plankton. Nonetheless this pump is increasingly affected by global climate change, which raises questions and concerns. What is the resilience of plankton communities? How vulnerable is this sophisticated climate machine?

The role of plankton biodiversity in climate regulation therefore represents one of the major issues for the global climate.



Biological carbon pump