

How marine snow cools the planet

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Professor Dietmar Muller from the School of Geosciences, University of Sydney. Credit: University of Sydney

University of Sydney scientists have modelled how carbonate accumulation from 'marine snow' in oceans has absorbed carbon dioxide over millennia and been a key driver in keeping the planet cool for millions of years.

The study, published in *Geology*, also helps our understanding of the [ocean](#)'s future capacity to store [carbon dioxide](#), which is vital given warming-ocean acidity has increased 30 percent since 1800.

"Marine snow is the falling debris of dead organisms in the ocean, such as plankton and algae," said the study's lead author, Dr. Adriana Dutkiewicz.

"The deep ocean floor is covered with the remains of these tiny sea creatures. They produce more than 25 percent of the oxygen we breathe and form the Earth's largest carbon sink. When organic particles fall from the surface ocean to the seafloor, a small but significant proportion of atmospheric carbon is stored away."

When compacted over millions of years, these marine snow deposits become carbonate structures, such as the White Cliffs of Dover and similar structures along England's south coast. These chalk cliffs and their related structures under the ocean act as millennia-old carbon capture devices.

"Deep-sea carbonates represent a huge volume, so even [small changes](#) in the sequestration of carbonate carbon into this enormous sink are quite important for understanding net changes in atmospheric carbon dioxide and climate," Dr. Dutkiewicz said.

Her team found that the amount of carbon stored in carbonate layers on the seafloor has increased tremendously over time. About 80 million years ago, only one megatonne of carbon ended up in carbonate layers annually, growing to about 30 megatonnes about 35 million years ago and 200 megatonnes today.

While carbonates forming in shallow waters decreased, the rise in deeper deposits was far greater, creating a net increase in the total volume of

carbonate sediments in the oceans in the past 80 million years.

The study used data from drilled core samples from the past 50 years to develop a dynamic model describing the formation of carbonate deposits back 120 million years to the Cretaceous period.

Marine snow forms a blanket on the seafloor up to many hundreds of metres thick. Understanding what it is composed of, what drives its composition and how it has changed through time is important. If the supply of [marine snow](#) increases, then more carbon is stored, reducing the atmosphere's CO₂ content.

To understand how much carbon has been stored over time in sedimentary carbonates in the ocean basins, Dr. Dutkiewicz and her colleagues from the [EarthByte](#) group in the School of Geosciences, University of Sydney, developed a computer model of carbonate accumulation in deep-sea sediments spanning the past 120 million years. The researchers used the model to look at the impact of [carbonate](#) accumulation on [global climate](#) through time.

The researchers believe that the growth of a significant carbon sink over millions of years may be responsible for the removal of carbon dioxide from the atmosphere that led to global cooling 50 million years ago, triggering the transition from a hothouse to an icehouse climate around 35 million years ago.

The recently released [Australian Bureau of Meteorology \(BOM\) and CSIRO biennial State of the Climate report](#) stresses the importance of oceans as carbon sinks, potentially holding future warming extremes at bay.

"We need to understand better how the ocean's capacity to store CO₂ will be affected by future warming," said EarthByte team leader

Professor Dietmar Muller. "Ocean acidity has increased by 30 percent since 1800, reducing the capacity of the ocean to store away carbon."

Dr. Dutkiewicz urged funding agencies and the scientific community to devote more resources to synthesising the incredible amount of data collected over 50 years of ocean drilling expeditions at a [total cost of about \\$US200 million](#).

"This enormous ocean drilling investment and data set should be used much more extensively for understanding Earth's deep carbon cycle," she said. "Once you have coherent databases, a wide array of questions could be addressed."

More information: Adriana Dutkiewicz et al, Sequestration and subduction of deep-sea carbonate in the global ocean since the Early Cretaceous, *Geology* (2018). [DOI: 10.1130/G45424.1](https://doi.org/10.1130/G45424.1)

Provided by University of Sydney

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