
Rate of Ocean Acidification Unprecedented in 65 Million Years: Study

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Rate of ocean acidification the fastest in 65 million years

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-- A new model, capable of assessing the rate at which the oceans are acidifying, suggests that changes in the carbonate chemistry of the deep ocean may exceed anything seen in the past 65 million years.

The model also predicts much higher rates of environmental change at the ocean's surface in the future than have occurred in the past, potentially exceeding the rate at which plankton can adapt.

The research, from the University of Bristol, is reported in this week's issue of Nature Geoscience.

The team applied a model that compared current rates of ocean acidification with the greenhouse event at the Paleocene-Eocene boundary, about 55 million years ago when surface ocean temperatures rose by around 5-6°C over a few thousand years. During this event, no catastrophe is seen in surface ecosystems, such as plankton, yet bottom-dwelling organisms in the deep ocean experienced a major extinction.

Dr Andy Ridgwell, lead author on the paper, said: "Unlike surface plankton dwelling in a variable habitat, organisms living deep down on the ocean floor are adapted to much more stable conditions. A rapid and severe geochemical change in their environment would make their survival precarious.

"The widespread extinction of these ocean floor organisms during the Paleocene-Eocene greenhouse warming and acidification event tells us that similar extinctions in the future are possible."

The oceans are currently absorbing about a quarter of the CO₂ released into the atmosphere, forcing the pH of the surface ocean lower in a process called 'ocean acidification'.

Laboratory experiments suggest that if the pH continues to fall, we may start to see impacts such as the dissolution of carbonate shells of marine organisms, slower growth, muscle wastage, dwarfism or reduced activity, with knock-on effects throughout the ecosystem.

Dr Daniela Schmidt, also an author on the paper, explained: 'Laboratory experiments can tell us about how marine organisms react, but experiments cannot tell us whether marine organisms will be able to adapt to ocean acidification via migration or evolution.

'Therefore, a lot of attention has recently focussed on looking at known ocean acidification and biotic reactions in the geological record. Various types of geological evidence - the spread of warm water organisms towards the poles and the dissolution of carbonate sediments on the sea-floor tell us there was simultaneously both extreme warming and acidification at this time - the hallmark of a massive greenhouse gas release.'

On the basis of their approach of comparing model simulations of past and future marine geochemical changes, the authors infer a future rate of surface-ocean acidification and environmental pressure on marine calcifiers, such as corals, unprecedented in the past 65 million years, and one that challenges the potential for plankton to adapt.

They also argue that for organisms which live on the sea floor, rapid and extreme acidification of the deep ocean would make their situation uncertain. The occurrence of widespread extinction of these organisms during the Paleocene-Eocene greenhouse warming and acidification event raises the possibility of a similar extinction in the future.

