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'Scary' climate message from past

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Data came from samples brought up by the drilling ship Joides Resolution

A new historical record of carbon dioxide levels suggests current political targets on climate may be "playing with fire", scientists say.

Researchers used ocean sediments to plot CO₂ levels back 20 million years.

Levels similar to those now commonly regarded as adequate to tackle climate change were associated with sea levels 25-40m (80-130 ft) higher than today.

Scientists write in the journal Science that this extends knowledge of the link between CO₂ and climate back in time.

The last 800,000 years have been mapped relatively well from ice cores drilled in Antarctica, where historical temperatures and atmospheric content have left a series of chemical clues in the layers of ice.

But looking back further has been more problematic; and the new record contains much more precise estimates of historical records than have been available before for the 20 million year timeframe.

Sustained levels

The new research was able to look back to the Miocene period, which began a little over 20 million years ago.

At the start of the period, carbon dioxide concentrations in the atmosphere stood at about 400 parts per million (ppm) before beginning to decline about 14 million years ago - a trend that

eventually led to formation of the Antarctic icecap and perennial sea ice cover in the Arctic.

“ **If anyone still doubts the link between CO2 and climate, they should read this paper** ”

Jonathan Overpeck
University of Arizona

The high concentrations were probably sustained by prolonged volcanic activity in what is now the Columbia River basin of North America, where rock formations called flood basalts relate a history of molten rock flowing routinely onto the planet's surface.

In the intervening millennia, CO2 concentrations have been much lower; in the last few million years they cycled between 180ppm and 280ppm in rhythm with the sequence of ice ages and warmer interglacial periods.

Now, humanity's emissions of greenhouse gases are pushing towards the 400ppm range, which will very likely be reached within a decade.

"What we have shown is that in the last period when CO2 levels were sustained at levels close to where they are today, there was no icecap on Antarctica and sea levels were 25-40m higher," said research leader Aradhna Tripathi from the University of California at Los Angeles (UCLA).

"At CO2 levels that are sustained at or near modern day values, you don't need to have a major change in CO2 levels to get major changes in ice sheets," she told BBC News.

The elevated CO2 and sea levels were associated with temperatures about 3-6C (5-11F) higher than today.

No doubting

The data comes from the ratios of boron and calcium in the shells of tiny marine organisms called foraminifera.

The ratio indicates the pH of sea water at the time the organisms grew, which in turn allows scientists to calculate the carbon dioxide content of the atmosphere.

The shell fragments came from cores drilled from the floor of the Pacific Ocean.

According to Jonathan Overpeck, who co-chaired the Intergovernmental Panel on Climate Change (IPCC) work on ancient climates for the organisation's last major report in 2007, this provides a more accurate look at how past CO2 values relate to climate than previous methods.



The Boxer-Kerry bill envisages stabilisation at 450ppm

"This is yet another paper that makes the future look more scary than previously thought by many," said the University of Arizona scientist.

"If anyone still doubts the link between CO₂ and climate, they should read this paper."

The new research does not imply that reaching CO₂ levels this high would definitely result in huge sea level changes, or that these would happen quickly, Dr Tripathi pointed out - just that sustaining such levels on a long timescale might produce such changes.

"There aren't any perfect analogies in the past for climate change today or in the future," she said.

"We can say that we've identified past tipping points for ice sheet stability; the basic physics governing ice sheets that we've known from ice cores are extended further back, and... I think we should use our knowledge of the physics of climate change in the past to prepare for the future."

Averting danger

At the Rio Earth Summit of 1992, governments pledged to stabilise greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic interference with the climate system".

What that level is has been the subject of intense debate down the years; but one figure currently receiving a lot of support is 450ppm.

On Tuesday, for example, the International Energy Agency (IEA) released its prescription for tackling climate change, which sees concentrations of greenhouse gases peaking at the equivalent of 510ppm of CO₂ before stabilising at 450ppm.

The Boxer-Kerry Bill, which has just entered the US Senate, also cites the 450 figure.

"Trouble is, we don't know where the critical CO₂ or temperature threshold is beyond which ice sheet collapse is inevitable," said Dr Overpeck.

"It could be below 450ppm, but it is more likely higher - not necessarily a lot higher - than 450ppm.

"But what this new work suggests is that... efforts to stabilise at 450ppm should avoid going up above that level prior to stabilisation - that is, some sort of 'overshoot' above 450ppm on the way to stabilisation could be playing with fire."

Because of concerns about short-term sea level rise, the Association of Small Island States (Aosis), which includes low-lying countries such as The Maldives, Palau and Grenada, is pushing for adoption of the much lower figure of 350ppm.

But with concentrations already substantially higher, political support for that is scanty outside Aosis members.

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