



This is the print version of the [Skeptical Science](http://sks.to/pastco2) article '[CO2 was higher in the past](http://sks.to/pastco2)', which can be found at <http://sks.to/pastco2>.

Do high levels of CO₂ in the past contradict the warming effect of CO₂?

What The Science Says:

The Ordovician glaciation was a brief excursion to coldness during an otherwise warm era, due to a coincidence of conditions. It is completely consistent with climate science.

Climate Myth: CO₂ was higher in the past

"The killer proof that CO₂ does not drive climate is to be found during the Ordovician-Silurian and the Jurassic-Cretaceous periods when CO₂ levels were greater than 4000 ppmv (parts per million by volume) and about 2000 ppmv respectively. If the IPCC theory is correct there should have been runaway greenhouse induced global warming during these periods but instead there was glaciation."

([The Lavoisier Group](#))

Geologists refer to ancient ice-cap formations and ice-ages as "glaciations." One such glaciation that occurred during the Late Ordovician era, some 444 million years ago has captured the attention of climate scientists and skeptics alike. To get some perspective on timing, that's just over 200 million years before dinosaurs began to roam the Earth.

Unlike other glaciations in the last 500 million years, this one was exceptionally brief (lasting perhaps only a million years or so) but the main reason for generating so much interest recently is because it took place when CO₂ levels were apparently sky-high. As Ian Plimer notes in his book, "Heaven and Earth", pp165:

"The proof that CO₂ does not drive climate is shown by previous glaciations...If the popular catastrophist view is accepted, then there should have been a runaway greenhouse when CO₂ was more than 4000 ppmv. Instead there was glaciation. Clearly a high atmospheric CO₂ does not drive global warming and there is no correlation between global temperature and atmospheric CO₂."

On the surface, Plimer does seem to have a point: if ice-caps managed to exist back then in an ultra-high CO₂ environment, why are the vast majority of climate scientists worrying so much about keeping CO₂ levels piddlingly low?

To answer this, we have to fill in some parts of the puzzle that are missing. Let's start with the CO₂.

Plimer's stated value of 4000 ppmv or greater is taken from Robert Berner's GEOCARB, a well-known geochemical model of ancient CO₂. As the Ordovician was so long ago, there are huge uncertainties for that time period (according to the model, CO₂ was between an incredible 2400 and 9000 ppmv.) Crucially, GEOCARB has a 10 million year timestep, leading Berner to explicitly advise against using his model to estimate Late Ordovician CO₂ levels due its inability to account for short-term CO₂ fluctuations. He noted that "exact values of CO₂... should not be taken literally."

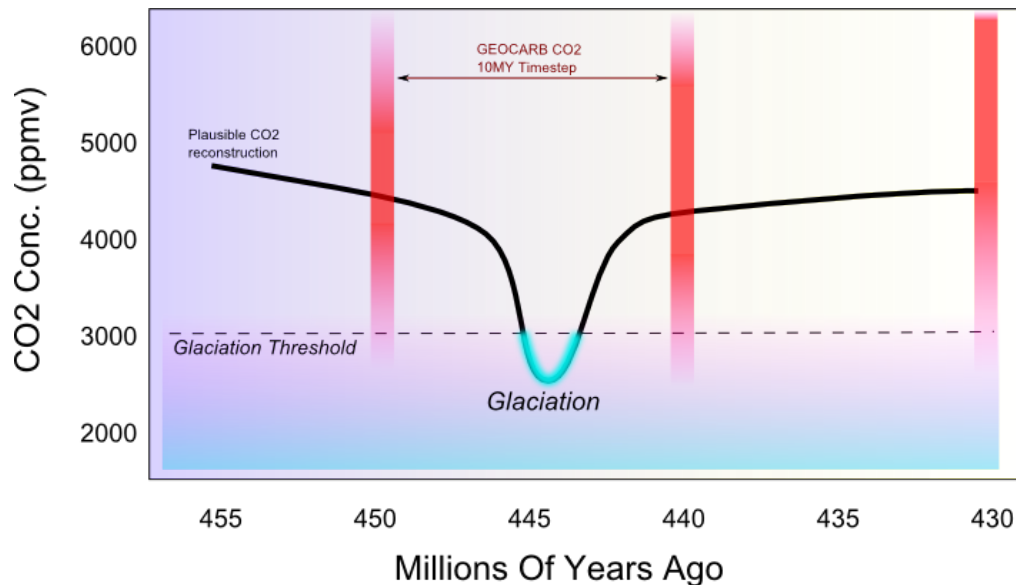
What about evidence for any of these short-term CO₂ fluctuations? Recent research has uncovered evidence for lower ocean temperatures during the Ordovician than previously thought, creating ideal conditions for a huge spurt in marine biodiversity and correspondingly large drawdown of CO₂ from the atmosphere through carbon burial in the ocean. A period of mountain-building was also underway (the so-called Taconic orogeny) increasing the amount of rock weathering taking place and subsequently lowering CO₂ levels even further. The

evidence is definitely there for a short-term disruption of the carbon cycle.

Another important factor is the sun. During the Ordovician, it would have been several percent dimmer according to established nuclear models of main sequence stars. Surprisingly, this raises the CO₂ threshold for glaciation to a staggering 3000 ppmv or so. This also explains (along with the logarithmic forcing effect of CO₂) why a runaway greenhouse didn't occur: with a dimmer sun, high CO₂ is necessary to stop the Earth freezing over.

In summary, we know CO₂ was probably very high coming into the Late Ordovician period, however the subsequent dip in CO₂ was brief enough not to register in the GEOCARB model, yet low enough (with the help of a dimmer sun) to trigger permanent ice-formation. Effectively it was a brief excursion to coldness during an otherwise warm era, due to a coincidence of conditions.

The following (somewhat simplified) diagram may make this easier to understand:



When looking at events such as these from the deep geological past, it is vital to keep in mind that there are many uncertainties, and generally speaking, the further back we look, the more there are. As our paleo techniques improve and other discoveries emerge this story will no doubt be refined. Also, although CO₂ is a key factor in controlling the climate, it would be a mistake to think it's the only factor; ignore the other elements and you'll most likely get the story wrong.

Basic rebuttal written by [steve.oconnor](#)

Update July 2015:

Here is a related lecture-video from [Denial101x - Making Sense of Climate Science Denial](#)



Skeptical Science explains the science of global warming and examines climate misinformation through the lens of peer-reviewed research. The website won the Australian Museum 2011 Eureka Prize for the Advancement of Climate Change Knowledge. Members of the Skeptical Science team have authored peer-reviewed papers, a [college textbook on climate change](#) and the book [Climate Change Denial: Heads in the Sand](#). Skeptical Science content has been used in university courses, textbooks, government reports on climate change, television documentaries and numerous books.



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