

# Snowball Earth at 2.3 gya

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*Source:* <http://sci.tech–archive.net/Archive/sci.bio.evolution/2005–08/msg00201.html>

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[http://pr.caltech.edu/media/Press\\_Releases/PR12723.html](http://pr.caltech.edu/media/Press_Releases/PR12723.html)

## Evolutionary Accident Probably Caused The Worst Snowball Earth Episode

PASADENA—For several years geologists have been gathering evidence indicating that Earth has gone into a deep freeze on several occasions, with ice covering even the equator and with potentially devastating consequences for life. The theory, known as "Snowball Earth," has been lacking a good explanation for what triggered the global glaciations.

Now, the California Institute of Technology research group that originated the Snowball Earth theory has proposed that the culprit for the earliest and most severe episode may have been lowly bacteria that, by releasing oxygen, destroyed a key gas keeping the planet warm.

In the current issue of the Proceedings of the National Academy of Sciences (PNAS), Caltech graduate student Robert Kopp and his supervising professor, Joe Kirschvink, along with alumnus Isaac Hilburn (now a graduate student at the Massachusetts Institute of Technology) and graduate student Cody Nash, argue that cyanobacteria (or blue–green algae) suddenly evolved the ability to break water and release oxygen about 2.3 billion years ago. Oxygen destroyed the greenhouse gas methane that was then abundant in the atmosphere, throwing the global climate completely out of kilter.

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The abstract of the PNAS article:

Although biomarker, trace element, and isotopic evidence have been used to claim that oxygenic photosynthesis evolved by 2.8 giga–annum before present (Ga) and perhaps as early as 3.7 Ga, a skeptical examination raises considerable doubt about the presence of oxygen producers at these times. Geological features suggestive of oxygen, such as red beds, lateritic paleosols, and the return of sedimentary sulfate deposits after a approximately 900–million year hiatus, occur shortly before the approximately 2.3–2.2 Ga Makganyene "snowball Earth" (global glaciation). The massive deposition of Mn, which has a high redox potential, practically requires the presence of environmental oxygen after the snowball. New age constraints from the Transvaal Supergroup of South Africa suggest that all three glaciations in the

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Huronian Supergroup of Canada predate the Snowball event. A simple cyanobacterial growth model incorporating the range of C, Fe, and P fluxes expected during a partial glaciation in an anoxic world with high-Fe oceans indicates that oxygenic photosynthesis could have destroyed a methane greenhouse and triggered a snowball event on timescales as short as 1 million years. As the geological evidence requiring oxygen does not appear during the Pongola glaciation at 2.9 Ga or during the Huronian glaciations, we argue that oxygenic cyanobacteria evolved and radiated shortly before the Makganyene snowball.

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My comment:

I tend to agree with the claim that oxygenic photosynthesis did not arise until 2.3 gya. But I am a little more skeptical of their claim that it triggered a catastrophic snowball event (1 km thick oceanic ice-cap at the equator!) that pretty much wiped out the too clever cyanobacteria and all other life except near vents.

Interesting, though.

There is also an article about this at NASA's "Astrobiology Magazine"  
<http://www.astrobio.net/news/index.php>

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• *Follow-Ups:*

- ◆ ***Re: Snowball Earth at 2.3 gya***  
    ◇ *From: yahooterry@xxxxxxxxxx*
- ◆ ***Re: Snowball Earth at 2.3 gya***  
    ◇ *From: yahooterry@xxxxxxxxxx*
- ◆ ***Re: Snowball Earth at 2.3 gya***  
    ◇ *From: yahooterry@xxxxxxxxxx*

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