

Re: Snowball Earth at 2.3 gya

Source: <http://sci.tech-archive.net/Archive/sci.bio.evolution/2005-08/msg00307.html>

- *From:* "Perplexed in Peoria" <jimmenegay@xxxxxxxxxxxxxxx>
 - *Date:* Tue, 16 Aug 2005 23:46:59 -0400 (EDT)
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"yahooterry@xxxxxxxx" <terryhilleman@xxxxxxxxxxxx> wrote in message
[news:ddmh11\\$1bob\\$1@xxxxxxxxxxxxxxxxxxxxxxxx](mailto:news:ddmh11$1bob$1@xxxxxxxxxxxxxxxxxxxxxxxx)

> This is just my opinion, but with an early-earth atmosphere similar to
> Jupiter, methane was likely the primary atmospheric greenhouse gas (25X
> as potent as CO₂), keeping water in liquid form at this time of lower
> sun intensity. Methane and ammonia seem to be stable on Jupiter and
> the other gas giants, in spite of the storms on the surface.

I just reread Kasting's 1993 review article "Earth's Early Atmosphere". (Science 259, Feb 12, 1993, pp920-926). It reminded me of the main argument that Earth either never had a Jupiter-like reducing accretion atmosphere, or that it lost it early. That argument is based on neon.

Neon is a noble gas with a fairly high solar and cosmic abundance. It is actually slightly more common than nitrogen, and comparable in abundance to carbon. If the Earth once had an accretion atmosphere of H₂ and CH₄, it would also have contained a lot of neon. Several bars of Neon. But Earth's current atmosphere has very little neon. Did we lose it? But any process that causes the Earth to lose neon would also lose H₂ and CH₄! A look at ratios of Ne(20) and Ne(22) provides more info. We lost that Neon in one fell swoop rather than gradually leaking it away.

However, unlike the gasses H₂, CH₄, and Ne, the Earth would have received H₂O, NH₃, and oxidized forms of carbon in solid form – as ices and as adsorbed materials in chondrites. This kind of stuff could be buried, protected from whatever process dissipated our original atmosphere of H₂, CH₄, and Ne. Then, as the Earth's interior gradually reorganized itself, it was outgassed.

As early as 4.4 Ga, Earth's atmosphere was primarily CO₂, CO, and H₂O. There would have been some H₂ (hot metallic meteorites react with water to form H₂) and some methane. But CO₂ and CO dominated, with combined partial pressures of something like 0.5–3 bar. And the CO fraction of that carbon would have decreased over time due to photolysis of water and escape of hydrogen. Similarly, NH₃ would decrease in favor of N₂.

- ***Follow-Ups:***

- ◆ ***Re: Snowball Earth at 2.3 gya***

- ◇ *From:* Wirt Atmar

- ***References:***

- ◆ ***Snowball Earth at 2.3 gya***

- ◇ *From:* Perplexed in Peoria

- ◆ ***Re: Snowball Earth at 2.3 gya***

- ◇ *From:* yahooterry@xxxxxxxxx

- Prev by Date: ***Re: DNA growth... Where and how does this happen?***

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