

# THE PRE-CAMBRIAN TIMES

## HADEAN, 4.6-4 Ga

**BREAKING NEWS...** “Theia”, a Mars-sized planet, has struck the newly formed planet Earth! Scientists believe that it struck Earth at around 4.4-4.6 Ga. This ground-breaking event certainly had its consequences, though. As a result of the debris from the impact coalescing, Earth now has its own Moon! The heat of the impact also created newly melted magma. However, Earth will now be rotating on a tilted axis and at a much faster pace. What an event!

### Other News...

- If you like water, you will be pleased to hear that by 4.4 Ga, Earth will have an ocean! This is thanks to the H<sub>2</sub>O from volcanic emissions condensing and the ice from impacted comets melting.
- Due to the heat of the Earth from radioactive decay, differentiation of the inside of the Earth occurred, which separated into different sections called the core, mantle, and crust. The denser materials sunk to the bottom while the lighter materials rose to the top.

Like antique minerals? Try [zircon minerals](#), the oldest minerals on planet Earth! They're 4.4 Ga and right from Australia.



### CLIMATE REPORT



The Hadean does not look so good... until around 3.8 Ga, expect frequent meteor and comet bombardments from outer space.

Furthermore, the crust and mantle will continue to be liquified by these impacts.

Volcanism throughout the Earth is also expected due to the abundance of heat from radioactive decay.

Meet: *The Moon*, Earth's new companion through space! The Moon will now be orbiting around the planet Earth.



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## ARCHEAN, 4-2.5 Ga

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**BREAKING NEWS...** There is now life on Earth! These organisms, who have the ability to reproduce and have a metabolism, are said to have been around as early as around 3.8 Ga. The first living organisms were most likely chemosynthetic and feasted on primordial soup. Yum! However, even in the Archean, some organisms have already evolved to be photosynthetic, and make energy off of sunlight. Of course, this wouldn't have been possible without the help of Carbon, Hydrogen, Oxygen, and Nitrogen, which help create protein and DNA.

### Other News...

- At around 3.8 Ga, it is believed that an important event called plate tectonics started. The evidence for this is the existence of ophiolites, which are chunks of oceanic plates that have been pushed onto continental plates because of convergent boundaries.
- Furthermore, subduction zones are another part of plate tectonics, where one plate subducts under another plate and partially melts. It is also important to know that the motion of tectonic plates is said to be driven by convection cells.

### CLIMATE REPORT



Luckily, there are significantly less meteor and comet bombardments in the Archean than in the Hadean, which makes it easier for life to form. However, expect very high and intense heat flow. Due to the faster convection cells, there will be multiple hot spots and smaller, faster-moving, tectonic plates.

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Proterozoic, 2,500-542 Ma

**BREAKING NEWS...** There has been a Great Oxygenation Event! This major event happened between 2.3-2.0 Ga. This increase of oxygen was because of the increase of oxygen-producing photosynthetic stromatolites. Because there weren't enough of the other elements to combine with oxygen, all of the chemical sinks filled up and oxygen started to accumulate in the atmosphere. Organic carbon was also buried in marine sediments, which covered it from the oxygen that would be used to decompose the organic matter. The increase in oxygen promoted animal diversification. It also helped fertilize the ocean by helping to create nitrate, which lead to more multicellular algae and acritarches.

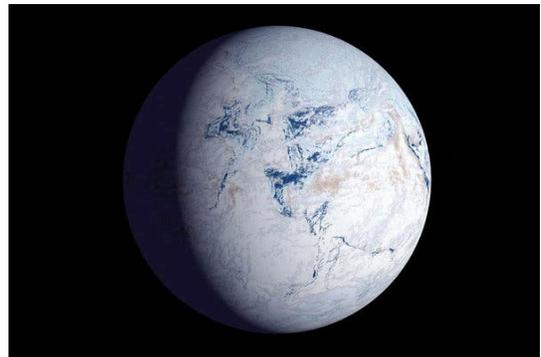
## Other News...

- Three supercontinents were created and later broke apart during the Proterozoic. At about 1.8-1.4 Ga, Nuna formed, which contained every continent at that time. Then Rodinia formed around 900-630 Ma, containing Laurentia, Antarctica, Australia, and South China. After that, at around 625-600 Ma, Pannotia assembled, which had Laurentia, Baltica, Africa, and South America.

***Hard shells, coming soon!***  
At the late Proterozoic-early Phanerozoic!



## CLIMATE REPORT



Be prepared for the cold, because there will be major time periods of glaciation at 2.3 Ga, 725 Ma, 650 Ma, and 580 Ma. During 725 Ma and 650 Ma, expect a 'Snowball Earth', with extensive glaciation throughout the planet. Because of there being less solar radiation hitting the Earth, the albedo effect, and less CO<sub>2</sub> in the atmosphere, glaciers expand. Eventually, global glaciation will end due to volcanism, less chemical weathering, an increase of greenhouse gases, and a change of the amount of Earth's insolation.

## Sources:

All information is from the lecture videos, the power point slides for Earth Through Time GEOL 102 B, or the YouTube video “That time oxygen almost killed everything”.

That Time oxygen almost killed everything:

<https://www.youtube.com/watch?v=qERdL8uHSgI>

Photos:

Hadean Climate: <https://en.wikipedia.org/wiki/Hadean>

Artist: Tim Bertelink

Moon: <https://en.wikipedia.org/wiki/Moon>

Photographer: Gregory H. Revera

Zircon Mineral: <https://www.livescience.com/43584-earth-oldest-rock-jack-hills-zircon.html>

Image Credit: John Valley, University of Wisconsin

Archean Climate: <https://en.wikipedia.org/wiki/Archean>

Artist: Tim Bertelink

Komatiite: <https://en.wikipedia.org/wiki/Komatiite>

Snowball Earth: <https://www.nytimes.com/2019/12/02/science/snowball-earth-ice-age.html>

Artist: Chris Butler

Shell fossil: <https://ucmp.berkeley.edu/precambrian/proterozoic.php>