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Effect of Cyanobacteria and Oxygen

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Cyanobacteria and oxygenic photosynthesis

- Cyanobacteria were the first organisms to evolve oxygenic photosynthesis
- Chloroplasts are captured cyanobacteria (endosymbiosis)

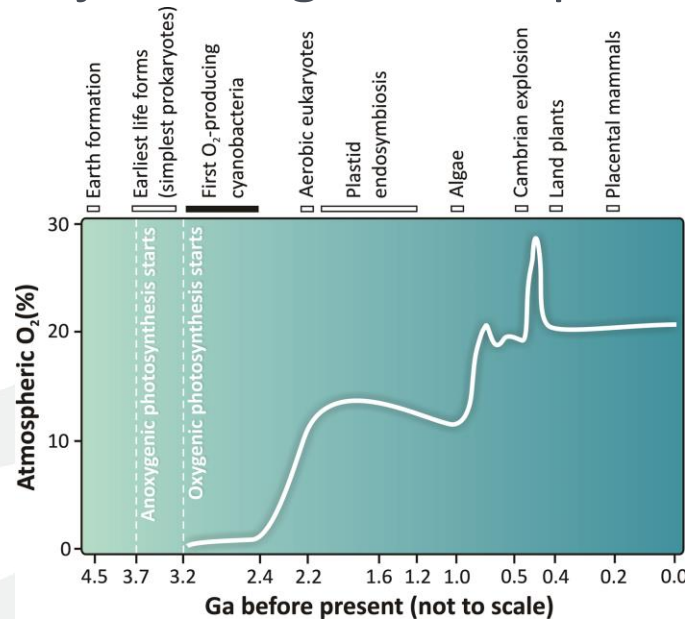


Cyanobacteria
(NOAA, public
domain)



Great Oxidation Event (GOE)

- The GOE is the rise of atmospheric oxygen to constant low levels for the first time in Earth's history
- This caused major changes in all spheres of Earth



Timeline of oxygenation and events in the history of life. (G and D Shevela 2011, Creative Commons)



Changes to the biosphere: primary production

- Oxygenic photosynthesis is very efficient (at least 10x more than other types)
- Inputs of carbon dioxide and water are abundant



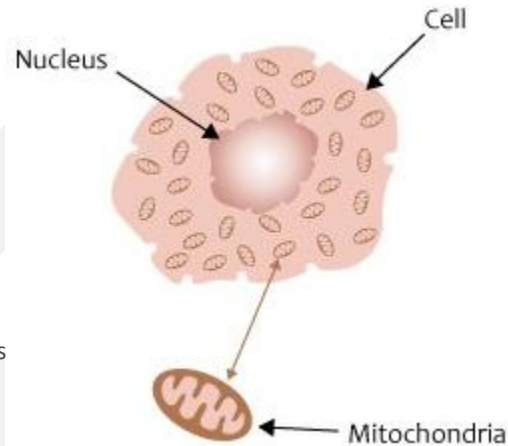
Changes to the biosphere: mass extinction

- Oxygen was toxic to most microbes
- This led to the first mass extinction



Changes to the biosphere: aerobic respiration

- Aerobic respiration (using oxygen) arose shortly after the evolution of oxygenic photosynthesis
- Aerobic respiration is much more efficient than anaerobic respiration



Aerobic respiration in human cells takes place in mitochondria (NHS Genomics Education Programme 2014, Creative Commons)



Changes to the geosphere

- Iron oxide deposits on land occur
- Minerals that decompose in oxygen become rare

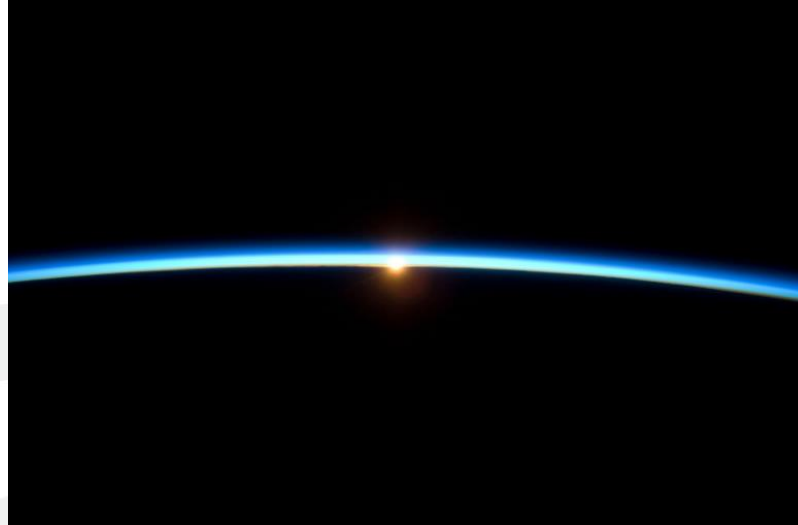


Red beds of Proterozoic age in lower strata of Grand Canyon (J St John 2007, Creative Commons)



Changes to the atmosphere

- Carbon dioxide decreased
- Oxygen increased
- Ozone layer begins to form



Earth's atmosphere and
the setting sun (NASA,
public domain)



Changes to the hydrosphere

- Decreased carbon dioxide
- Increased oxygen
- Final depletion of dissolved ferrous iron (Fe^{2+})



Other events at the time of the GOE

- Continental crust rises above oceans
- Volcanoes erupt on land
- Modern plate tectonics (subduction) begin





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