The Great Oxidation Event

Life Before The Great Oxidation Event

Life on Earth, in the form of single-celled organisms, is thought to have existed for at least a billion years before the Great Oxidation event
The first single-celled life may have developed 3.8 billion years ago, in undersea alkaline vents, and was probably made from self replicating RNA.
The oldest fossils of single-celled organisms date back 3.5 billion years, and some single-celled life may have fed on methane about 3.46 billion years ago. There are rock formations in Western Australia that some believe are fossilized microbes from 3.4 billion years ago.

Geological Evidence: The Three Prongs of Investigation

1. Biochemical analysis of oxygenic photosynthesis and its evolution as the main energy driver
2. Ancient rock, soil, and stromatolite investigation for the origin of photosynthesis
3. Plate tectonic, crust formation, and volcanic activity investigation for the geological and biological convergences to cause the event

"The reality is that the environment dictates the course of life, when at the same level, life dictates the course of the environment"
-Timothy Lyons, University of California, Riverside, geochemist

In essence, the Great Oxidation Event was a large coevolution that is investigated cross-disciplinarily by geochemists, biochemists, and geologists and to this day, how it happened is not totally understood

The Impact of The Great Oxidation Event on Earth and Its Species

- At the time the Great Oxidation Event Occurred, the Earth was only about 4.5 billion years old
- It was only inhabited by single-celled organisms that lived in the ocean
- No plants, animals, or insects
- Most bacteria were anaerobic, and metabolized their food without oxygen
- Cyanobacteria appeared "blue-green algae" and photosynthesized oxygen
- This caused the mass extinction of most bacteria
- The cyanobacteria began evolving into multicellular organisms approximately 2.3 billion years ago
- By breathing Oxygen, Organisms became much more active and much larger
- Moving on from multicellular organisms developed by cyanobacteria, some organisms become far more intricate such as plants, animals, sponges, worms, and fish.
- Multicellular cyanobacteria triggered the evolution of complex life, including humans, by producing oxygen on a global scale

Causes and Immediate Effects

<u>Causes:</u>

- Oxygen only appeared approximately 2.3 billion years ago
- Believed to have been caused by cyanobacteria
- Cyanobacteria evolved to take energy from sunlight (PHOTOSYNTHESIS) and became multicellular
- Possible theory as to why cyanobacteria evolved was that it was more beneficial for them (multicellular organisms would have an advantage spreading over single-celled organisms on mats)

<u>Immediate Effects:</u>

- Oxygen was poisonous to most organisms at the time
- Many anaerobic organisms, such as anaerobic bacteria, died off
- Left niches open for survivors
- Survivors evolved to fill in these roles (eventually leading to organisms similar to those of today)
- Arguably was the most significant impact on the environment in history

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