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Co-evolution of the atmosphere, oceans, and life over Earth's history

Earth is an aqua planet, which holds liquid water on the surface and can support life. For centuries, people have been wondering whether there are any other aqua planets in space. Until now, spacecraft explorations have revealed that there is no aqua planet in our solar system, other than Earth. In our galaxy, however, millions aqua planets are predicted to orbit in the habitable zone around stars. In fact, the challenge for finding aqua planets has started using space telescopes.

If aqua planets are discovered, people would then wonder the next questions. Is there life there? If so, what types of life? What are the signs of life there? Answering this question requires research at the interactions of life sciences, chemistry, physics, and earth sciences. Here, I discuss how the atmosphere, oceans, and life have evolved and interacted over Earth's history, especially focused on the first and largest rise in atmospheric oxygen in 2.5–2.2 billion years ago [1,2]. Our geochemical data suggest that the rise in atmospheric oxygen has occurred in the climatic recovery immediately after a global-scale glaciation (called "Snowball Earth event") [3,4]. These results suggest that drastic climate change have promoted the atmospheric evolution, which in turn has strongly affected the evolution of life. Knowledge on interactions between life and the Earth system would help us to consider alternative bio- and geochemistries that might occur on aqua planets beyond the solar system.

References

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