太古代における地球表層環境と海洋生物活動への制約
Constraints on the surface environments and the ocean biological activities in the Archean

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In the Archean, the climate of the Earth may have been warmer than that of today in spite of the lower luminosity of the Sun at that period [1]. The greenhouse effect of methane, in addition to that of carbon dioxide, is considered to have maintained the warm climate [2, 3], however, previous studies do not support the methane flux required for the warm climate [4]. In this study, we developed a coupled model of 1-D atmospheric chemistry –ocean ecosystem –biogeochemical cycle in order to investigate the biogenic methane flux in the Archean. We found that the biogenic methane flux could have been high enough to maintain warm climate if we assume ecosystem composed of multiple anoxygenic phototrophs which uses hydrogen and iron, with acetogen and methanogens, because of the $H_2-CH_2O-CH_4$ and $CO-CH_3COOH-CH_4$ biogeochemical cycles driven by $Fe-CH_2O-CH_4$ biogeochemical cycle could amplify the methane production nonlinearly through the recycling processes of organic matters.

[1] Walker et al., 1982, Palaeogeography, Palaeoclimatology, Palaeoecology, 40, 1. [2] Pavlov et al., 2001, Journal of Geophysical Research: Planets, 106, 23267. [3] Haqq-Misra et al., 2008, Astrobiology, 8, 1127. [4] Kharecha et al., 2005, Geobiology, 3, 53.

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