Modelling the behaviors of marine carbon isotopic composition after Neoproterozoic snowball Earth event

*Akari Miki[1], Eiichi Tajika[1], Kazumi Ozaki[2]

1. Department of Earth and Planetary Science, Graduate School of Science, The University of Tokyo, 2. Toho University

The atmospheric oxygen level is thought to have increased soon after the snowball Earth events in the early and late Proterozoic, leading to the modern oxygen-rich environment from a completely anoxic environment [e.g. 1-5]. A biogeochemical cycle model [6] predicts that an extremely hot climate immediately after the snowball Earth event should cause intense continental weathering and supply a large amount of nutrients into the ocean, leading to increases of primary productivity in the surface ocean and global organic carbon burial, which, in turn, results in an inevitable rise of the atmospheric oxygen level. However, since the massive organic carbon burial removes a large amount of light carbon isotopes from the environment, a positive excursion of marine carbon isotope ratio is predicted, which contradicts the marine carbon isotope record in the snowball Earth events in the Neoproterozoic. Here, we report an investigation of the behavior of marine carbon isotope ratio just after the snowball Earth event. We propose a possible scenario for explaining the negative excursion of carbon isotope ratio with a new idea that a temperature dependence of a rate of microbial decomposition of organic matter may explain an apparent negative anomaly of the carbon isotope ratio in seawater. We will compare this new scenario with various other scenarios proposed so far and discuss the possible scenario, with a marine biogeochemical carbon cycle model coupled with an atmospheric photochemical model.
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