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Constraints from Os isotope on fluctuations of atmospheric oxygen levels during the Great Oxidation Event

Kosuke Goto[1*], Yasuhito Sekine[2], Katsuhiko Suzuki[3], Eiichi Tajika[1], Ryoko Senda[3], Tatsuo Nozaki[3], Ryuji Tada[1], Kazuhisa Goto[4], Shinji Yamamoto[1]

[1]Dept. Earth Planet. Sci., Univ. of Tokyo, [2]Dept of Complexity Science and Engineeri, [3]IFREE, JAMSTEC, [4]DCRC, Tohoku Univ.

The great oxidation event (GOE) during the Paleoproterozoic is one of the largest chemical transitions in the earth's history. Understanding the causative mechanism responsible for the GOE is necessary to reveal the evolution of Earth's system and early life. However, the time variation in atmospheric oxygen levels during the GOE and its effect on the global biogeochemical cycle are poorly understood. A recent geochemical study on mass independent fractionations of sulfur isotope compositions in sedimentary sulfides from the Huronian Supergroup (Yamada et al., 2008, JpGU) suggests that the atmospheric oxygen levels would have been fluctuated across 10^-5 times the present atmospheric levels in the interglacial period between the second and last Huronian glaciations. To confirm the fluctuation of atmospheric oxygen levels and to reconstruct the cycle and intensity of the fluctuation during the interglacial period, more geochemical data using other proxies for reconstructing oxygen levels is needed. Here we show the isotopic compositions of osmium and other redox sensitive metals from Paleoproterozoic sediments of Bruce, Espanola, and Serpent Formations, Huronian Supergroup, Canada. These results suggest that the atmospheric oxygen once increased immediately after the second Huronian glaciation (Espanola Formation) and then declined in the interglacial period (Serpent Formation). Again, the atmospheric oxygen rose rapidly before the last Huronian glaciation in Paleoproterozoic, which is consistent with the sulfur isotopic records of South Africa reported by Bekker et al. (2004) and of the Huronian Supergroup by Yamada et al. (2008).