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エディアカラ紀および中生代の深海堆積物における Os 安定同位体および白金族元素組成
Os stable isotopes and Platinum Group Elements in Ediacaran and Mesozoic Deep-Sea Sediments

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Surface environmental change of the Earth has played a critical role on the evolution of life, particularly after the landing of life on continents since early Paleozoic. Recently by the help of understanding deep Earth and solar activity, the Earth's environment has been strongly affected by the Universe in relation to the Earth system. It is thought that there are four causes derived from universe of exchanging surface environment; (i) latter into extraterrestrial meteorite impact such as K/T, (ii) nearby supernova, (iii) periodical collision bombardment of icy and/or rocky meteorites from the Kuiper belt or far marginal region in the solar system, and (iv) collision of large molecular clouds, and (v) starburst due to collision of dwarf galaxy against our Milky-Way Galaxy. To understand the evolution of life and surface environmental change through time, it is essential to decode the history of cosmic flux to the Earth through time. The best container of cosmic flux is the deep-sea sediments which can be collected through time even back to 3.9 Ga on the Earth. From astronomical viewpoint, the interaction of Earth and Universe can be summarized as nearby supernovae, starbursts in our Galaxy, and collision of dark nebula, which produce abundant galactic cosmic ray and fall interstellar dusts.

In this study, we tried to analyze platinum group elements (PGE) of deep-sea clays collected from (1) the Triassic-Jurassic time in Japan, and (2) right before and after the Marinoan Snowball Earth in United Kingdom. We also examined (3) the cap carbonates at 635Ma from South China. The PGE pattern of IYF76 (Inuyama, Japan) formed in Tarucian (176Ma) is different from the other samples collected from the same area, with an elevated Os concentration enough for analyzing the Os stable isotope composition. However, the isotopic composition was not resolvable from the terrestrial value, suggesting the elevation of Os concentration with an anomalous PGE pattern was not caused by the input of extra-solar materials. For the samples from UK, we found a negative trend in the Pd/Ir versus Ir diagram. Two samples present the elevation of Ir concentration with relatively low Pd/Ir ratios, which is a suggestive of the existence of extraterrestrial dusts. To understand the origin of the putative extraterrestrial input, we need to precisely analyze stable Os isotope ratios for these samples. On the contrary, the Marinoan cap carbonates from south China possesses no sign of Ir accumulation. The maximum Ir abundance in the cap carbonates was 83 ppt, which is only 0.0007 times as much as that in Marinoan cap carbonates from the Eastern Congo craton (Bodiselitsch et al., 2005).

References

Bodiselitsch et al. (2005) Science 308, 239-242.

Keywords: surface environmental change, deep-sea sediments, Os stable isotopes, extraterrestrial input, Marinoan glaciation, T/J boundary