Study on productivity feedback during the recovery phases of early Eocene hyperthermals: Comparison between the central North Pacific Ocean and southern Indian Ocean

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The Paleocene-Eocene Thermal Maximum (PETM) at 56 Ma was the most serious and well-studied hothouse in the Cenozoic era, characterized by a rapid global warming by 5 to 8˚C, severe ocean acidification, and a distinct negative carbon isotope ($\delta^{13}C$) excursion both in the marine and terrestrial realms [1]. These features suggest a massive injection of ^{13}C-depleted greenhouse gas(es) to the ocean-atmosphere system. Moreover, during the early Eocene period (ca. 56-52 Ma), multiple PETM-like transient global warming episodes, called hyperthermals, have also been recognized over the past dozen years [2].

A previous study using the ODP legacy cores drilled in the southern Indian Ocean indicated that an enhanced biological pump efficiently sequestered the excess carbon in the recovery phases of the PETM and other modest hyperthermals, regardless of the magnitude of the events [3]. However, it remains uncertain whether this productivity feedback is a globally general response of the Earth system to a rapid warming.

Here we newly analyzed deep-sea sediment samples collected from ODP Site 1215A in the central North Pacific Ocean, in which multiple hyperthermal events including the PETM, Eocene Thermal Maximum (ETM) 2 and ETM3 are recorded [4]. We constructed a multi-elemental dataset of major- and trace-element contents, $\delta^{13}C$, $\delta^{18}O$, and $CaCO_3$ content for bulk sediment. Based on the dataset, we estimated the abundance of Ba associated with the biological productivity. In the presentation, we will compare the results in the central North Pacific Ocean and southern Indian Ocean, and discuss their relationships with the multiple hyperthermal events.

[1] McInerney and Wing (2011) *Ann. Rev. Earth Planet. Sci.* **39**, 489-516.
[2] Zachos et al. (2010) *Earth Planet. Sci. Lett.* **299**, 242-249.
[3] Yasukawa et al. (2017) *Sci. Rep.* **7**, 11304.
[4] Leon-Rodriguez and Dickens (2010) *Palaeogeogr. Palaeoclimatol. Palaeoecol.* **298**, 409-420.

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