

Global atmospheric pCO₂ changes during the Early Aptian OAE 1a

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The Early Aptian OAE 1a (~120 Ma) represents a major perturbation of the global carbon cycle and records profound environmental changes including increased temperature, promoted primary productivity and marine anoxia. Multiple geochemical proxies (e.g. total organic carbon, carbon isotope, metal stable isotopes) have been used to study the forming and developing mechanisms of OAE 1a, which led to a universal understanding that the environmental changes were driven by the emission of enormous CO₂ into the ocean-atmosphere system [1].

Carbon isotope fractionation ($\Delta^{13}\text{C}_{\text{carb-org}}$) in the sediments is one of the most important indicators of the atmospheric pCO₂. Here, we report new paired carbon isotopes of the sediments from the ODP site 866A in the western Pacific and the Lingshan Island section in the Sulu orogenic belt. The $\delta^{13}\text{C}_{\text{carb}}$ and the $\delta^{13}\text{C}_{\text{org}}$ from both sections correlate well with OAE 1a. The $\Delta^{13}\text{C}_{\text{carb-org}}$ show a distinct positive shift (~7-11‰) and a negative shift (~5-6‰) during C3-C6, suggesting that the atmospheric pCO₂ rose in the early OAE 1a and fell in the late OAE 1a. The reported $\Delta^{13}\text{C}_{\text{carb-org}}$ from the Cau section, Cismon section and the Roter Sattel section in the western Tethys also have similar trends, which further support the significant atmospheric pCO₂ changes during OAE 1a on a global scale [2].

However, the sediments also show a few variations in carbon isotope records during OAE 1a between different sections, which may be related to different local environments. For example, the $\Delta^{13}\text{C}_{\text{carb-org}}$ reaches the maximum at various positions in different sections. In future research, we intend to combine C-Mo-Zn isotopes to clarify the influence of different environmental factors, in which Mo isotope can reflect the transformation between sulfide and non-sulfide of the local environment, and Zn isotope can indicate enhanced/weakened primary productivity and organic-rich sediment burial/decomposition.

[1] Jenkyns, *Geochemistry of oceanic anoxic events* (2010). *Geochemistry Geophysics Geosystems* 11.

[2] Wu et al., Carbon isotope of the Early Cretaceous sediments from the West Pacific and the Sulu orogenic belt: Implying the global atmospheric pCO₂ changes during the Early Aptian Oceanic Anoxic Event 1a (2023). *Deep-Sea Research Part I* 193.