

Seawater incursion history of Cretaceous Songliao paleo-lake revealed by specific marine biological markers

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Many large lakes have been formed since Triassic in Northern China. Seawater incursion events (SWIEs) in those lakes were well discussed in the past but lack solid evidence to confirm and methodology to reconstruct the detail processes. The present study employs specific marine biological markers, 24-*n*-propyl cholestanes, 24-isopropyl cholestanes, to trace SWIEs in a well dated core in Songliao Basin (SLB).

The absolute abundances of extractable 24-*n*-propyl cholestanes, 24-isopropyl cholestanes and dino steranes are 0-15.68, 0-2.93 and 0-3.91 $\mu\text{g}\cdot\text{g}^{-1}$ in the SK1 core, respectively. The temporal distributions of these C₃₀ sterane biomarkers indicate that marine organic matter input to the gigantic ancient freshwater lake, i.e. SWIEs mainly occurred in the Upper Cretaceous Qingshankou and Nenjiang formations. SWIEs in Qingshankou stage started from 91.37 Ma and terminated in 89.00 Ma, with time span of 1.37 Ma. While, SWIEs in Nenjiang stage was triggered in 84.72 and ended in 83.72 Ma, with narrower time span of 1.00Ma.

High total organic carbon (TOC) and negative $\delta^{13}\text{C}_{\text{org}}$ excursion in sediments during seawater incursion are interpreted by high productivity in the lake as enhancement of nutrient supplies, and high aqueous CO₂ due to the mixing of alkalic seawater and acidic lake water. The SWIEs in SLB were controlled by regional tectonic activity and eustatic variation. Movement direction changes of Izanagi/Kula plate in 90 and 84 Ma created sinistral slip faults and triggered SWIEs[1,2]. High sea level from 90 to 84 Ma [3,4] also facilitated the occurrence of SWIEs in Songliao Lake.

[1] Norton (2007) Geological Society of America Special Paper **430**, 451-470. [2] Yang (2013) Earth Sci. Rev. **126**, 96-115. [3] Haq et al. (1987) Science **235**, 1156-1167. [4] Müller et al (2008) Science **319**, 1357-1362.