

Late Cretaceous (Santonian) lake anoxic events (LAEs) in the Songliao Basin, NE China

Xi, Dangpeng^{1,*}, Sames, B.², Shi, Z.¹, Wan, X.¹, Wagreich, M.²

1) China University of Geosciences (Beijing), Beijing, China, *E-mail: xdp1121@163.com

2) Department of Geodynamics and Sedimentology, University of Vienna, Vienna, Austria

Cretaceous ocean anoxic events (OAEs) have been well studied, but the lake anoxic events (LAEs) are still little understood. The Songliao Basin (SLB) in northeastern China is one of the largest Cretaceous continental rift basins in the world. The largest lake transgression event (largest extent of the Songliao paleo-lake) occurred during the Santonian, with black and oil shales preserved in the Lower Nenjiang Formation (K_{2n}), indicating a 'lake anoxic event' (LAE) (HUANG et al., 1998). The Lower K_{2n} is divided into Member 1 (K_{2n}¹) and Member 2 (K_{2n}²). The lowermost K_{2n}¹ and lowermost K_{2n}² mainly consist of black shale and oil shale, both in the central and marginal parts of the basin, while the middle–upper K_{2n}¹ and the middle–upper K_{2n}² are mainly composed of grayish and grayish green mudstone. The black and oil shales of the lowermost K_{2n}¹ and lowermost K_{2n}² are characterized by high TOC (~5 % on average), high Fe²⁺/Fe³⁺, high reducing sulfur and a wide distribution of black and oil shales (HUANG et al., 1998; Xi et al., 2011), indicating a stable, stratified deep lake with anoxic bottom water. We suggest that two large-scale lake anoxic events (LAE2a and LAE2b) occurred during sedimentary of the lowermost K_{2n}¹ and lowermost K_{2n}², respectively.

LAE2a and LAE2b of the Songliao Basin occurred at about 85.7 Ma and 83.4 Ma. Considering the thickness of lake anoxic deposits (5–10 m) and average sedimentary rates (~50 m/Ma), the LAE2a and LAE2b might have lasted 0.1–0.2 Ma, respectively. LAE2a and LAE2b coincide with the beginning of the two large lake transgression events, when the lake level rose dramatically. During the LAEs, the Songliao paleolake was also periodically affected by seawater incursion events. Therefore, the LAEs may have been affected by changes in both regional lake level and climate as well as global sea level and climate change, respectively. OAE3 occurred during the Coniacian–Santonian (WAGREICH et al., 2002). The Cretaceous Songliao Basin has been well correlated and compared with the Western Interior Seaway (WANG et al., 2013). Considering the age interval covered, LAE2 might be related to an early Santonian OAE3. This may be because both were affected by the relatively high sea level of the Pacific Ocean and the high primary productivity in the lake during this period.

HUANG, Q. et al. 1998. *Acta Micropalaeontol. Sin.*, **15**, 417–425.

WAGREICH, M., 2012. *Clim. Past*, **8**, 1447–1455.

WANG, C. et al., 2013. *Earth Sci. Rev.*, **126**, 275–299.

Xi, D. et al., 2011. *Island Arc*, **20**, 6–22.