

Evolution of the Late Cretaceous clam shrimps in the Songliao Basin, northeastern China

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The almost complete Upper Cretaceous continental sequences and the 2485.89 m scientific drilling cores of SKI in the long-lived Songliao Basin of northeastern China provide an excellent opportunity to reconstruct a Late Cretaceous green house climate in East Asia (WANG et al., 2013). The established astronomical time scale (WU et al., 2013) and geomagnetic polarity chrons (HE et al., 2012) provide a precise calibration for the correlation of strata and events between marine and terrestrial systems (WAN et al., 2013).

The Late Cretaceous clam shrimps in the Songliao Basin are abundant and diverse, whose rapid evolution makes them biostratigraphically very useful for subdividing and classifying non-marine strata (CHEN et al., 2007). First, *Jilinesstheria* of the *Nemestheria* fauna evolved to *Dictyestheria* during the late Coniacian by the development of reticulation on the whole carapace, indicating the beginning of age of the *Euestherites* fauna. Subsequent developments led to the chain-like ornament of *Halysesstheria* during the Santonian (lower Nenjiang Formation). By the beginning of the Campanian in a high lake water level environment *Halysesstheria* evolved to *Euestherites* (with cavernous ornament) and *Tylestheria* (with widely spaced, pronounced radial lirae with intercalated short fine radial lines and cross bars), respectively. At last, *Calestheria* evolved from *Euestherites* through the development of a row of caves along the lower margin of each growth band. During the middle Campanian, *Mesolimnadiopsis* (attributed to Lioestheriaceae), the end member of the *Euestherites* fauna appeared, which has growth lines slightly recurved near the posterior end of the dorsal margin. A Maastrichtian *Daxingestheria* fauna occurs in the Mingshui Formation. The carapace in *Daxingestheria* is ornamented with widely spaced short and long lirae, the short lirae on both the lower and upper parts of each growth band.

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