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Charophytes from the Cretaceous – Paleogene transition in the Pingyi Basin (Eastern China) and their Eurasian correlation

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ABSTRACT

Charophytes from uppermost Campanian to Paleocene deposits in the Pingyi Basin (Shandong Province, Eastern China) are studied from the perspectives of taxonomy, paleoecology, biogeography, and biostratigraphy. The taxonomy of charophytes used by previous authors is revisited based on a study of intraspecific gyrogonite polymorphism, facilitating comparisons between China and Europe. A number of synonymies are proposed. *Gobichara deserta* is confirmed as a younger synonym of *Microchara cristata*. The genus *Euaclistochara* Z. Wang is shown to be a younger synonym of *Lamprothamnium* J. Groves. Charophyte assemblages from the Pingyi Basin were generally species-poor but showed a high degree of variation depending on the paleoenvironment. During the latest Campanian–Maastrichtian, brackish water assemblages were monospecific, formed by *Feistiella anluensis*. Permanent lakes were dominated by *Microchara cristata* and *Peckichara praecursoria*. *Lamprothamnium ellipticum* and *Mesochara voluta* inhabited the overbank ponds near braided rivers. The Paleocene was much more homogeneous and was dominated by *Peckichara varians* in permanent lakes. A new biozonation is proposed which encompasses two biozones based on species with broad paleoecological requirements and a Eurasiatic distribution. These are the *Microchara cristata* biozone starting in the latest Campanian and lasting at least until the earliest Danian and the *Peckichara varians* biozone encompassing the late Danian–earliest Eocene. These biozones allow direct correlation between Chinese and European basins.

1. Introduction

Charophytes are macroscopic algae living in fresh or brackish waters, preferring shallow oligotrophic lacustrine environments. Their calcified fructifications, called gyrogonites, are usually abundant and well-preserved in non-marine deposits, and display relatively high evolutionary rates that render them appropriate biostratigraphic tools. In Europe and China, charophytes in Upper Cretaceous and Paleocene deposits have long been used to characterize the Cretaceous/Paleogene (K/Pg) boundary. However, the use of different taxonomies and concepts in these studies has hampered comparison of the results obtained by researchers in these two parts of Eurasia. Here we conduct a taxonomic and biostratigraphic study with the aim of reconciling the two traditions in order to correlate the charophyte record from one end of Eurasia to the other.

The non-marine K/Pg boundary in China is far less well characterized than in Europe. However, charophyte biostratigraphic markers of the boundary are abundant and provide significant clues for its characterization. In China, K/Pg boundary charophytes are well represented in the Songliao, Pingyi, North Jiangsu, Jianghan, and Nanxiong Basins. However, identification of species has generally been based on a limited number of fructifications from boreholes, making it difficult to assess intraspecific polymorphism, which is usually very significant in charophytes (Soulié-Märsche, 1989; Sanjuan and Martín-Closas, 2015). This has resulted in the definition of a number of new taxa, which actually represent intraspecific morphotypes rather than well-characterized species, hampering the correlations with Europe and even between different Chinese basins.

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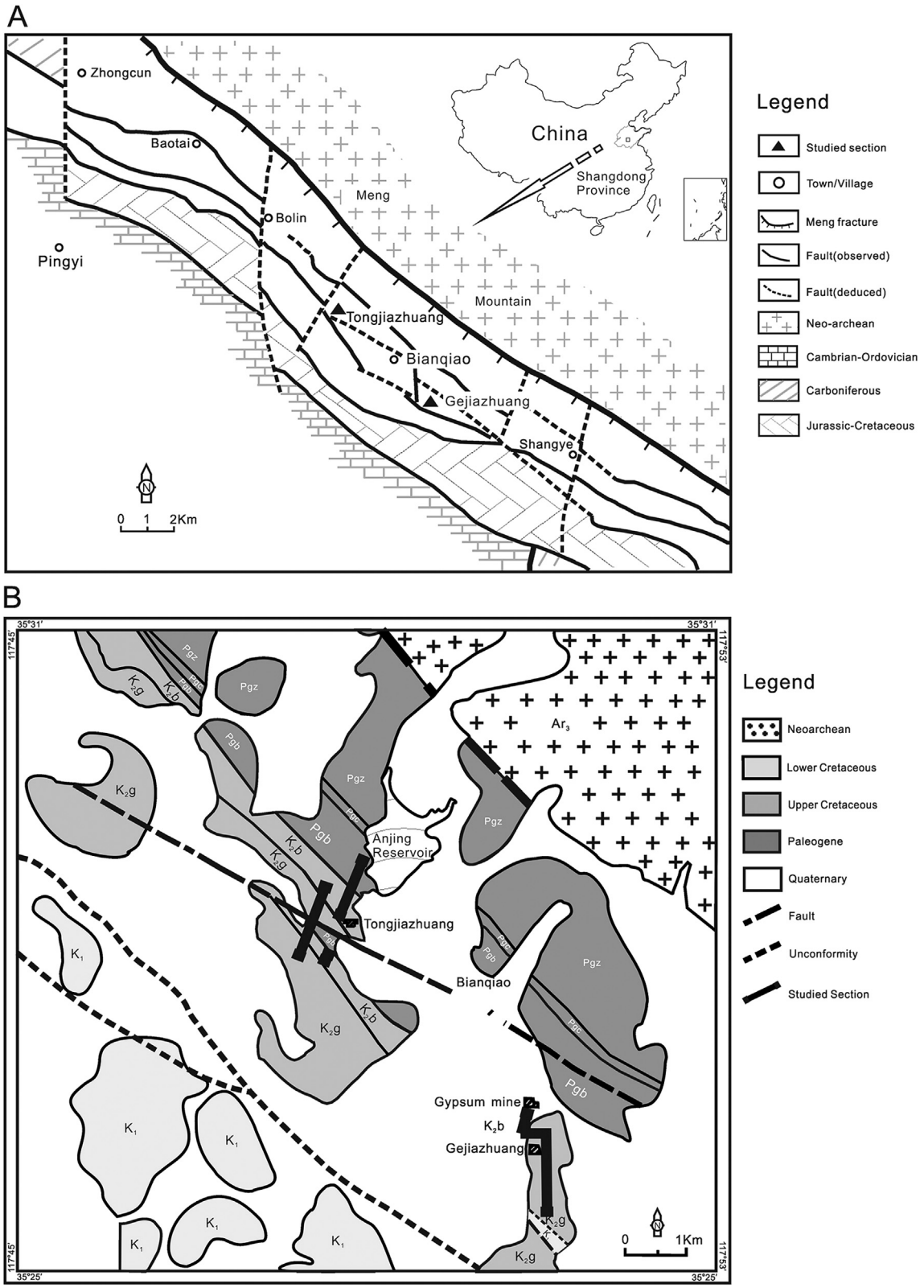

Fig. 1. Geological setting of the study area. A. Geological sketch of the Pingyi Basin; B. Geological map of the study area showing the location of the sections studied. Legend: Ar_3 Neoarchean rocks, K_1 Lower Cretaceous; K_2g Gucheng Formation, K_2b and Pgb Bianqiao Formation, Pgc Changlu Formation, Pgz Zhujiagou Formation, Q Quaternary deposits, modified from Lin et al. (2011) and Lu in Zhang et al. (2014).