

A Research of the Cretaceous-Paleogene Boundary in the Pingyi Basin, Shandong Province

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How to cite this paper: Chen, J., Du, S.X., Chen, C., Liu, F.C., Ning, Z.G., Song, X.S., Liu, S.C., Lu, H.N., Liu, Y.Q. and Kuang, H.W. (2019) A Research of the Cretaceous-Paleogene Boundary in the Pingyi Basin, Shandong Province. *Open Journal of Geology*, 9, 661-664.

<https://doi.org/10.4236/ojg.2019.910068>

Received: August 16, 2019

Accepted: September 21, 2019

Published: September 24, 2019

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Abstract

The Bianqiao Formation (in the Pingyi Basin, Shandong Province, China) is a typical set of continuous lacustrine carbonate deposits during the Cretaceous-Paleogene period, which is considered as an ideal stratigraphic unit for KP research. This study is based on the borehole PYZK01, which is located at Tongjiazhuang village in Bianqiao Town of Pingyi country. According to biostratigraphy research, the Bianqiao Formation establishes one charophyte assemblage: *Porocharaanluensis-Charayuntaishanensis* var. *acuta-Turbocharaspecialis*, and one sporopollen assemblage: *Deltoidosporaadriensis-Rugubivesiculites-Schizaeoisporites*. This result indicates that the stratigraphic age during 0 - 12.25 m is the Paleogene, 37.8 m - 60 m is the Late Cretaceous, and 12.25 - 37.8 m is a transition stage from the Late Cretaceous to the Paleocene. By geochemical study, it was established carbon and oxygen isotopic strata in the drill. Through the magnetostratigraphy research, we find eight positive polarity zones and seven reversed polarity zones, build the magnetic polarity sequences of the borehole, and propose a contrast scheme with the international standard magnetic polarity time column. After comprehensive discussion, it is preliminarily believed that the Cretaceous-Paleogene boundary is located at the depth of 31.98 m in PYZK01, namely, in the first section of the Bianqiao Fm.

Keywords

Cretaceous-Paleogene Boundary, Biostratigraphy, Isotopic Stratigraphy,

Magnetostratigraphy, Pingyi Basin

At the turn of the Cretaceous and the Paleogene, major events occurred all over the world, such as the mass extinction of dinosaur and the rise of mammals, and the research of the Cretaceous-Paleogene boundary has become a hotspot. Although the research of KPB has made important progress, many important problems still have not been solved in non-marine stratigraphy [1] [2] [3] [4]. So the establishment of the non-marine Cretaceous-Paleogene boundary stratigraphy is necessary. The Bianqiao Fm of the Guanzhuang Group in the Pingyi Basin of Shandong Province is a typical set of fluvial and lacustrine deposits, mainly consisted of carbonate rocks and gypsum ore beds, near the Mesozoic-Cenozoic boundary in China. Besides, it is also one of the strata units with the largest thickness of continuous sedimentary limestone in continental lacustrine basins in the same period in our country, which contains very important geological information, such as biological, sedimentary, and terrestrial carbonate lake basin evolution. Much great progress has been made in KPB [5] [6] [7] [8] [9]. Based on previous work, we conduct a comprehensive study on biostratigraphy, isotopic stratigraphy, and magnetic stratigraphy of PYZK01, which is the first time in the region.

In terms of petrostratigraphy, it is continuous that the whole lithology shows a set of sedimentary characteristics with alternating shore-shallow lacustrine facies and shallow lacustrine facies. From the perspective of sedimentary environment, the lithology mainly consists of gray, purple and flesh-red limestone and marl, indicating the dry and hot palaeoclimate environment. However, reductive environmental strata represented by dark sediments no longer appeared above 31.57 m, showing obvious rapid changes or abrupt events of sedimentary environment and paleocaterium, which may be related to geological events at the turn of the Cretaceous to the Paleogene.

In terms of biostratigraphy, we obtain abundant fossils of chardonophytes, palynophytes, metamorphoses and gastropods. Among them, *Sphaerochara cf. chinensis* (Huang et Xu) was found at 12.25 m, indicating that the strata shallower than 12.25 m are not earlier than the Paleogene. The charophyte assemblage of *Porocharaanluensis-Charayuntaishanensis* var. *acuta-Turbocharaspecialis* indicates that the stratigraphic age deeper than 40.03 m was determined as the late Late Cretaceous, and it is also further confirmed by the palynological assemblage of *Deltoidosporaadriensis-Rugubivesiculites-Schizaeoisporites* from 37.8 m to 40.3 m and the gastropod fossils from 37.8 m to 57.5 m. Thus, the KPB is limited of 12.25 m to 37.8 m by biostratigraphy.

In terms of magnetostratigraphy, we find eight positive polarity zones and seven reversed polarity zones, build the magnetic polarity sequences of the borehole, and propose a contrast scheme with the international standard magnetic polarity time column. The KPB was further restricted to the third reverse polarity zone which is from 25.7 m to 37.6 m, and a significant negative drift of the

susceptibility curve occurred at the depth of 31.98 m.

In terms of isotopic strata, carbon and oxygen isotopic strata were established, and an obvious phenomenon of oxygen isotopic curve positive drift and carbon isotopic curve negative drift also appeared at 31.98 m.

Based on the above results, the Bianqiao Fm in the Pingyi Basin has the Cretaceous-Paleogene boundary, and its location is basically confirmed to 31.98 m deep in PYZK01, namely, in the first section of the Bianqiao Fm.

Acknowledgements

This study was supported by the China Geological Survey Project “Study on Shandong Paleogene Stratigraphic Division Comparative” (1212011120146) and Major Innovative Project of Shandong Province “Exploration and Exploitation of Deep Earth Resources” and “Study on oil and gas occurrence conditions in the Riqingwei Basin in east sea of Shandong province” (2017CXGC1608), “Deep structure of Yishu fault zone and its impact on resources and environment” (2017CXGC1602). This is a contribution to UNESCO-IUGS IGCP Project 679.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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