

Late Turonian Microfossils and Paleoclimate in the Songliao Basin, NE China

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Abstract

Although the paleoclimate of the marine Cretaceous has been well studied, the paleoclimate of the non-marine is still not well understood. The Songliao Basin was one of the largest non-marine rift basins during Cretaceous. The Well-preserved Cretaceous lacustrine deposits in this basin provide a unique opportunity to study terrestrial paleoenvironments and paleoclimate during the Late Cretaceous. Here, the microfossils from the Late Turonian Qingshankou Formation of the Songliao Basin were used to investigate the paleoenvironments and paleoclimate of east Asia. There are two spore and pollen assemblages recognized: a *Cedripites-Cyathidites-Classopollis* assemblage from Upper Member 1, and a *Cedripites-Cyathidites-Classopollis* assemblage from Lower Member 2 of the Qingshankou Formation, respectively. Besides, relatively abundant ostracods have been identified. In the Songliao Basin, the climate was relatively warm and wet during Late Turonian, with good source rock deposited in the Songliao lake.

Keywords

Cretaceous, Songliao Basin, Spore and Pollen, Paleoclimate

1. Introduction

The Songliao Basin was one of the largest non-marine rift basins during Cretaceous [1]. Widespread deposits in the basin are mainly composed of clastic sediments which contain abundant fossils, such as spore and pollen, clam shrimps, ostracods, gastropod, bivalves and vertebrates. These spore and pollen fossils provide us valuable information about Cretaceous climate changes and biotic responses in a greenhouse environment. Although the paleoclimate of the marine Cretaceous has been well studied [2] [3], the paleoclimate of the non-marine is

still not well understood. The Well-preserved Cretaceous lacustrine deposits in this basin provide a unique opportunity to study terrestrial paleoenvironments and paleoclimate during the Late Cretaceous [4] [5]. Here, the microfossils from the Late Turonian Qingshankou Formation of the Songliao Basin were used to study the paleoenvironments and paleoclimate of East Asia.

2. Materials and Methods

The samples were collected from Upper Member 1 to Lower Member 2 of the Qingshankou Formation of the Lijiatuozi section in the Songliao Basin. Analyses of spore and pollen and ostracod samples were carried out in the microfossil laboratory. The organic residues recovered were sieved through a 10 µm mesh screen, after which they were boiled in potassium hydroxide solution (KOH, 10%) for 10 min to remove soluble humic substances. The sieved residues were strewn mounted on glass slides using epoxy. The slide numbers were prefixed 'mg' for Well Mao-206 which is another name of SK1(S). In case of less productive samples, we prepared another four slides to scan and count.

3. Results and Discussion

Preliminary analysis of spore and pollens, as well as ostracods from the Upper Member 1 to Lower Member 2 of the Qingshankou Formation has been taken. Two spore and pollen assemblages have been recognized. *Cedripites-Cyathidites-Classopollis* assemblage is belong to Upper Member 1 of the Qingshankou Formation, including *Cyathidites*, *Schizaeoisporites*, *Cicatricosporites*, *Lygodioisporites*, *Balmeisporites*, *Cedripites*, *Podocarpidites*, *Classopollis*, *Pinuspollenites*, *Abiespollenites*, *Piceapollenites*, *Quercoidites*, *Chenopodipollis* and a few other taxa. *Cedripites-Cyathidites-Classopollis* assemblage is belong to Lower Member 2 of the Qingshankou Formation, including *Schizaeoisporites*, *Foraminisporis*, *Cedripites*, *Classopollis*, *Taxodiaceapollenites*, *Rugubivesiculites*, *Psophosphaera*, *Cycadopites*, *Quercoidites*, *Callistopollenites*, *Salixipollenites*, *Beaupreaidites*, *Tricolporopollenites*, and a few other taxa. The spore and pollen fossils suggest that the climate was relatively warm and wet during this period (Late Turonian), but a little dry during sedimentation of the Lower Member 2 of the Qingshankou Formation. Beside the spore and pollens, the ostracods fossils have been identified, including *Cypridea dekhoinensis*, *C. gibbosa*, *C. bistyloformis*, *C. tuberculata*, *C. adumbrata*, *C. aff. adumbrata*, *C. nota*, *C. fuyuensis*, *Triangulicypris tosuosus* var. *nota*, *T. virgate*, *T. torsuosus*, *T. fertilis*, *T. similis* and *Limnocypridea*, suggesting a fresh to slightly brackish water environment.

The Upper Member 1 to Lower Member 2 of the Qingshankou Formation has been dating as Late Turonian [6] [7] [8] [9]. The global paleoclimate was suggested to hot during this period [2]. Based on the core of SK1(s) from the Songliao Basin, a detailed study of spore and pollen suggested a relatively warm and wet climate during Late Turonian [5], which is consistent with our results. Dur-

ing Late Turonian (Upper Member 1 to Lower Member 2 of the Qingshankou Formation), the Songliao lake was deep in central part, but relatively shallow in marginal part, with good source rock deposited in the central part of this large lake. The spore and pollens suggested that a relatively warm and wet paleoclimate in East Asia during Late Cretaceous.

4. Conclusion

Relatively abundant spore and pollen, as well as ostracods have been discovered in the Lijiatuozi section of the Upper Member 1 to Lower Member 2 of the Qingshankou Formation, including two spore and pollen assemblages and one ostracod assemblage. In the Songliao Basin, the climate was relatively warm and wet during Late Turonian, with good source rock deposited in the central part of the Songliao lake.

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Conflicts of Interest

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

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