

## Research Advances

# A New Palynological Assemblage from the Nenjiang Formation of Dayangshu Basin, and its Geological Implication



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## Objective

The Dayangshu Basin located in eastern Inner Mongolia, is one of the key areas for oil and gas exploration in the periphery of Songliao Basin. So far, this basin has been poorly explored, and the basic geological research is still weak, due to the lack of high-quality paleontologic and stratigraphic data. The previous oil and gas investigations were mainly focused on the Early Cretaceous strata. However, the Late Cretaceous Nenjiang Formation in the basin also has hydrocarbon potential according to the latest research. In recent oil and gas geological survey, palynological fossils have been discovered from the Nenjiang Formation in the Dayangshu Basin, providing new evidence for biostratigraphic division and correlation.

## Methods

Five grey black mudstone samples were collected from the outcrops of Nenjiang Formation, Ganhe area, Central Dayangshu Basin. The samples were treated with hydrochloric and hydrofluoric acid to remove carbonates and silicates, respectively. An Olympus BX51 biomicroscope was used for fossil imaging and identification. All slides are stored at the Palynology Lab, Research Center of Paleontology and Stratigraphy, Jilin University.

## Results

All the five samples were rich in palynological fossils. Based on the quantitatively important taxa, the *Cedripites medius* - *Podocarpidites nageiaformis* - *Lythraites giganteus* palynological assemblage was recognized. The characteristics of this assemblage are as follow (Fig. 1):

(1) It is dominated by gymnosperm pollen (89.45–98.48%), followed by pteridophyte spores (1.27–8.00%), and angiosperm pollen are rare (0–2.55%).

(2) Pteridophyte spores are diverse in terms of number of species, but their abundance is low. They include *Verrucosisporites* sp. (0–1.31%), *Klukisporites* sp. (0–



Fig. 1. Typical palynological fossils from Nenjiang Formation, Dayangshu Basin

(1) *Lycopodiumsporites* sp.; (2) *Biretisporites* sp.; (3) *Cicatricosisporites* sp.; (4) *Leiotriletes* sp.; (5) *Hymenophyllumsporites* sp.; (6) *Lygodiumsporites* sp.; (7) *Schizaeoisporites retiformis*; (8) *Verrucosisporites* sp.; (9) *Borealipollis songliaoensis*; (10) *Callistopollenites tumidoporus*; (11) *Lythraites giganteus*; (12–13) *Pentapollenites asymmetricus*; (14–15) *Parcisporites parvisaccus*; (16–18) *Cedripites medius*; (19) *Cedripites microsaccoides*; (20) *Podocarpidites nageiaformis*; (21) *Pinuspollenites labdacus*; (22) *Piceapollenites* sp.; (23–24) *Abiespollenites* sp..

1.09%), and other species that are typically less than 1%, such as *Lycopodiumsporites* sp., *Schizaeoisporites* sp., *S. retiformis*, *Leiotriletes* sp., *Calamospora* sp., *Cyathidites* sp., *C. minor*, *Foveosporites* sp., *Polycingulatisporites* sp., *Biretisporites* sp., *Hymenophyllumsporites* sp., *H. osmundaformia*, *Verrucosisporites* sp., *Lophotriletes* sp., *Klukisporites* sp., *Baculatisporites* sp., *Lygodioisporites* sp., *Lygodiumsporites* sp., *Cyclogranisporites* sp., *Granulatisporites* sp., *Ceratosporites equalis*, *Radiorugoisporites* sp., *Cicatricosisporites* sp., *Camazonotriletes* sp., *Toroisporis* sp., *Aequitriradites*

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*spinulosus*, *Densoisporites* sp., and *Appendicisporites* sp..

(3) *Cedripites medius* (32.00–40.61%) is dominant among the gymnosperm pollen, followed by *Podocarpidites nageiaformis* (5.96–29.74%), *Parcisporites parvisaccus* (9.55–15.64%), *Pinuspollenites labdacus* (5.23–11.78%) and *Psophosphaera* sp. (3.81–12.63%). *Abietinaepollenites* sp. (0–5.08%), *A. minimus* (0–7.02%), *Abiespollenites* sp. (0–3.51%), *Keteleeriaepollenites* sp. (0–4.06%) and *Piceapollenites* sp. (1.09–6.67%) are common. *Cycadopites* sp., *Abietinaepollenites microsibiricus*, *Cedripites* sp., *Ce. densireticulatus*, *Ce. leptodermis*, *Ce. microsaccoides*, *Pinuspollenites minutes*, *Parcisporites minutes*, *Rugubivesiculites* sp., *Protopinus* sp., *Protoconiferus* sp., *Pseudowalchia* sp., *Pristinuspollenites* sp., *Perinopollenites* sp. and *Araucariacutes* sp. are rare.

(4) Among the angiosperm pollen, *Retitricolpites* sp., *Liquidambarpollenites* sp., *Borealipollis* sp., *B. yaojianica*, *B. songliaoensis*, *Callistopollenites tumidoporus*, *Lythraites giganteus*, *Consoliduspollenites songliaoensis*, *Pentapollenites asymmetricus*, and *Euphorbiacites majorporus* are seen, but the abundance of each species is less than 1%.

Most of pteridophyte spores and gymnosperm pollen recovered in this study were commonly seen in the Mesozoic Songliao Basin (Wang Chenglong et al., 2017, 2018). However, the angiosperm pollen have biostratigraphic significance. *Callistopollenites tumidoporus*, *Consoliduspollenites songliaoensis*, *Lythraites giganteus* and *Pentapollenites asymmetricus* are typical fossils in the Nenjiang Formation of the Songliao Basin, *Borealipollis songliaoensis* is distributed from the Nenjiang Formation to the Mingshui Formation, and *Borealipollis yaojianica* is found in the Yaojia Formation

in the Songliao Basin. In general, the palynological assemblage reported in this paper can be correlated with that of the Nenjiang Formation in the Songliao Basin. The palynoflora of angiosperm pollen reflect the characteristics of both the “*Lythraites-Xinjiangpollis* stage” and the “Advanced angiospermous pollen stage” that were recognized by Zhang Yiyong (1999). The geological age of the Nenjiang Formation in the Dayangshu Basin is thought to be Coniacian-Campanian.

## Conclusion

A new palynological assemblage, *Cedripites medius* - *Podocarpidites nageiaformis* - *Lythraites giganteus* assemblage was reported from the Nenjiang Formation in the Dayangshu Basin. According to the palynological data, the geological age of the Nenjiang Formation of the Dayangshu Basin is thought to be Coniacian-Campanian.

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