Preliminary Study of the Palynoflora from Lacustrine Sediments on the North Bank of the Kongque River, Xinjiang (72–51 ka BP): Postprint

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Abstract

OSL dating and pollen record analyses were conducted on lacustrine sediments from the LX02 section on the northern margin of the Kongque River in Xinjiang. The results indicate that the lacustrine deposition at this section spanned from 72.4 ka B.P. to 51.0 ka B.P. During this interval, the study area supported coniferous and broad-leaved mixed forest vegetation, with shrubs and herbs in the understory, and fern spores and algae in low-lying, moist areas. The principal vegetation types included Pinus, Quercus, Castanea, Corylus, Cyperaceae, Artemisia, Chenopodiaceae, and Polypodiaceae, along with minor quantities of pollen from subtropical relict taxa such as Carya and Pterocarya. Specifically, during the depositional periods corresponding to assemblage zones I (72.4–66.8 ka B.P.) and III (56.1–51.0 ka B.P.), broad-leaved tree pollen percentages were low while shrub and herb pollen percentages were high; conversely, assemblage zone II (66.8–56.1 ka B.P.) exhibited elevated broad-leaved tree pollen content with relatively lower shrub and herb pollen, indicating that the climate in the study area from 72.4 to 51.0 ka B.P. was characterized by overall cold-dry/warm-wet oscillations. This pattern is consistent with paleoclimate characteristics and variations reflected by clay mineral and geochemical proxies, and also correlates well with findings from studies on ostracod abundance in the eastern Qaidam Basin, OSL chronology of high lake stands in the eastern Qaidam Basin, and organic carbon isotope records from the Beijing Plain. Nevertheless, the internal driving mechanisms underlying this climate change regime require further investigation.

Full Text

Preamble

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This study investigates the paleoenvironmental record of the Lop Nur region in Xinjiang, northwestern China, focusing on the interval between 72.4 ka BP and 51.0 ka BP. Optically Stimulated Luminescence (OSL) dating was applied to establish the chronological framework. Pollen analysis reveals a diverse assemblage including *Pinus* (pine), *Quercus* (oak), *Castanea* (chestnut), *Corylus* (hazel), *Cyperaceae* (sedges), *Artemisia* (sagebrush), *Chenopodiaceae* (goosefoot family), and *Polypodiaceae* (polypody ferns), with subsidiary occurrences of *Carya* (hickory) and *Pterocarya* (wingnut) indicating subtropical influences.

Based on variations in major pollen types and the ratio of broadleaved tree pollen to shrub and herb pollen, the sequence is divided into three zones: Zones I (72.4–66.8 ka BP) and III (56.1–51.0 ka BP) are characterized by low broadleaved arboreal pollen and high shrub/herb pollen, while Zone II (66.8–56.1 ka BP) shows the opposite pattern with high broadleaved tree pollen and low shrub/herb pollen. This pattern reflects fluctuating climate conditions between dry-cold and humid-warm states during the Late Pleistocene.

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1. Study Area and Geological Setting

The Lop Nur region, located in southeastern Xinjiang, represents one of the most arid areas in China, with a hyper-arid climate and extremely low precipitation [**?**]. The study area is situated at the northern margin of the Kongqi River alluvial fan, where geomorphological processes have created favorable conditions for sediment accumulation. The region covers approximately 1.0×10 km^2.

The modern climate is characterized by strong evaporation, minimal rainfall, and frequent dust storms. The terrain slopes gently from northeast to southwest. The LX02 sedimentary section, the focus of this investigation, is positioned at the northern edge of the Kongqi River alluvial plain at an elevation of 813 m. The section coordinates are 89°55 E, 40°40 N, with a total thickness of 5.4 m. The stratigraphy consists primarily of fine-grained lacustrine sediments interbedded with fluvial deposits, reflecting alternating phases of lacustrine and fluvial deposition.

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2. Methods and Results

2.1 Chronology

Six OSL samples were collected from the LX02 section at depths of 0.18 m, 1.19 m, 2.21 m, 3.10 m, 3.71 m, and 4.69 m. The resulting ages are presented in Table 1, establishing a chronological sequence from 72 ka BP to 51 ka BP. The age-depth relationship follows a linear trend described by the equation:

$$Y = 3.950X + 51.007$$

with $R^2 = 0.9087$ (Fig. 3), indicating reliable stratigraphic continuity.

Table 1. Relationship between depth and OSL age for the LX02 section

Depth (m)	Age (ka BP)
0.18	53.1 ± 4.4
1.19	56.1 ± 3.2
2.21	57.9 ± 3.3
3.10	60.5 ± 4.0
3.71	67.0 ± 6.0
4.69	71.0 ± 3.6

2.2 Pollen Analysis

A total of 80 pollen samples were analyzed from the 5.4 m section, with sampling intervals of 1.5–15 cm. The samples yielded 13,541 identifiable pollen and spore grains (averaging 169 grains per sample). Forty-seven spore and pollen taxa were identified, dominated by arboreal pollen (18.91%–91.03%, mean 58.20%), with subordinate shrubs and herbs (8.97%–60.12%, mean 35.02%) and minor ferns and algae (0.00%–13.64%, mean 6.78%).

The pollen assemblage indicates that the study area was generally covered by coniferous and broadleaved forests during the deposition period, with vigorous growth of various shrubs and herbs in the understory. Ferns and algae were primarily distributed in low-lying humid microenvironments. Dominant taxa include *Pinus*, *Quercus*, *Castanea*, *Corylus*, *Cyperaceae*, *Artemisia*, *Chenopodiaceae*, and *Polypodiaceae*. Subtropical elements such as *Carya* and *Pterocarya* appear sporadically at low frequencies.

2.3 Paleoclimatic Zonation

Based on major pollen type variations and the ratio of broadleaved tree pollen (B.T.P.) to shrub and herb pollen (S.P. + H.P.), the sequence is divided into three climatic zones:

Zone I (72.4–66.8 ka BP) and Zone III (56.1–51.0 ka BP): Characterized by consistently low broadleaved arboreal pollen and high shrub/herb pollen, indicating dry-cold conditions. The B.T.P./(S.P. + H.P.) ratio ranges from 0.18 to 0.35 (mean 0.69).

Zone II (66.8–56.1 ka BP): Marked by high broadleaved tree pollen and low shrub/herb pollen, reflecting humid-warm conditions. The B.T.P./(S.P. + H.P.) ratio shows correspondingly higher values.

These fluctuations correlate well with: 1. Weathering intensity variations indicated by clay mineralogy and geochemistry [**?**, **?**] 2. Ostracod abundance records from the southeastern Qaidam Basin [**?**] 3. Regional paleoclimate patterns documented in previous studies [**?**, **?**]

The climate mode of alternating dry-cold and humid-warm periods during 72–51 ka BP in the Kongqi River region is consistent with regional paleoclimatic records, though the internal forcing mechanisms require further investigation.

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Note: Figure translations are in progress. See original paper for figures.