

Holocene Environmental Change Inferred from High-Resolution Pollen Records of Inland Lake Deposits, Arid China

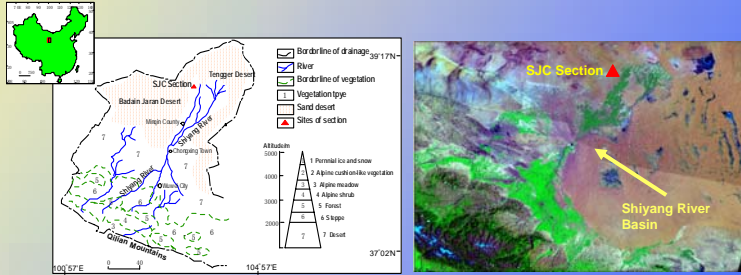
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Introduction

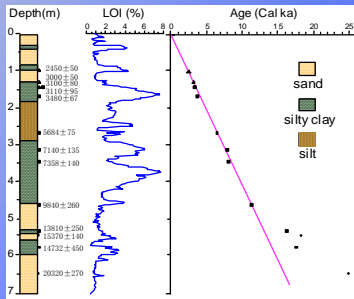
The arid history during the present Holocene interglacial could provide analogs for the future climatic variations in the Eurasian continent interior. Here we use pollen records of a terminal lake in a Chinese desert to support our previous finding that Holocene climate in arid and summer monsoon margin regions was generally unstable with a specially strong drought in the mid-Holocene (Chen, et al, 2001,2003; Zhu, et al, 2002).

Geographical Settings



The Shiyang River drainage lies on the northern side of the Qilian Mountain, the northern margin mountain of the Tibetan Plateau, and at the eastern end of the Hexi corridor, The drainage is on the margin of present E. Asian summer monsoon in arid western China, an area where climate is strongly influenced by both the E. Asian Monsoon and the prevailing Westerlies. Study site (SJC Section 39°00'38''N/103°20'25''E) is indicated as a triangle.

Lithology and Laboratory Methods



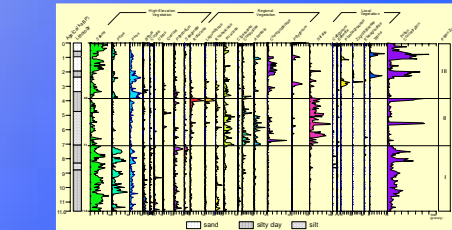
Pollen samples were taken from a 700 cm deep section (SJC) in a terminal lake of Shiyang River, with a resolution of 50 year interval. The sediments of the section consist of silty clay, silt and sand.

The chronology of the section is controlled by thirteen radiocarbon dates on charcoal, bulk organic matter and pollen concentrates. The section spans from the last glacial to the present.

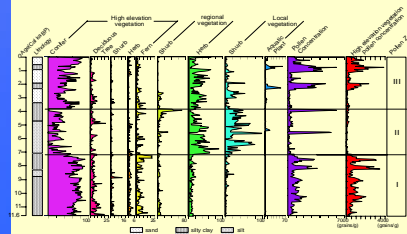
Sample No.	Lab No.	Depth	Material	Method	C-14 Age (Cal BP)	Carbon reservoir Corrected Age (Cal BP)	Tree-ring Calibrated Age (Cal AD)
SJC-C03	Gf6100272	106cm	Charcoal	AMS	2450±50	No need	2532
SJC-C03-4	LZU00-22	136cm	Ash Charcoal	¹⁴ C	3000±50	No need	3192
SJC-C04	Gf6100272	145cm	Charcoal	AMS	3180±50	No need	3319
Sjcb3	LZU00-23	130-148cm	Organic matter	¹⁴ C	3641±95	3110±95	3319
Sjcb4	LZU00-24	168-176cm	Organic matter	¹⁴ C	4010±67	3480±67	3755
Sjcb5	LZU00-25	266-272cm	Organic matter	¹⁴ C	6214±75	5684±75	6499
Sjcb6	LZU00-26	310-316cm	Organic matter	¹⁴ C	7670±135	7140±135	7954
Sjcb7	LZU00-27	340-350cm	Organic matter	¹⁴ C	7888±140	7358±140	8166
Sjcb8	LZU00-28	465-476cm	Organic matter	¹⁴ C	10375±260	9840±260	11239
Sjcb9	LZU00-29	532-552cm	Organic matter	¹⁴ C	14340±250	13810±250	16200
SJC-C11	Beta14280	550cm	Pollen concentration	AMS	15900±140	15370±140	18366
Sjcb10	LZU00-30	570-590cm	Organic matter	¹⁴ C	15262±450	14732±450	17645
SJC-C21	Beta14281	650cm	Pollen concentration	AMS	20850±270	20320±270	25072

Pollen Assemblages

Standard techniques were employed for pollen extraction and analysis with some modifications. The pollen assemblages are shown in the following Figures.



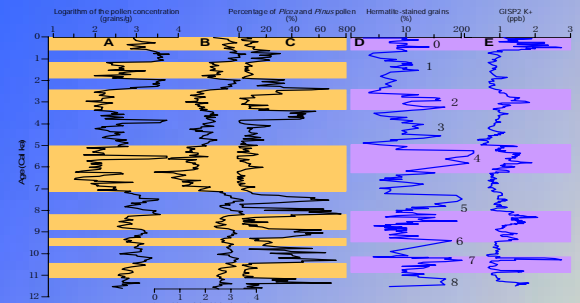
Pollen percentage diagram and pollen zones at the SJC section



SJC section pollen diagram presented as the sum of ecological groups

The early Holocene (11.6-7.1 cal ka) was wet, as indicated by forest trees, including *Sabina*, *Picea* and *Pinus*, which dominated in the pollen assemblages; while the mid-Holocene (7.1-3.8 cal ka) was dry with desert and steppe shrubs and herbs dominated, such as *Nitraria*, *Poaceae*, *Compositae* and *Artemisia*. The late Holocene (3.8-0 cal ka) turned to be wet again and alternatively dominated by *Pinus* and *Sabina* and desert-steppe vegetation.

Discussion and conclusions



Comparisons of pollen concentrations (A), the high elevation vegetation pollen concentrations (B) and *Picea-Pinus* percentages at the SJC section (C) with percentages of hemateite-stained grains in Core VM29-191 in the North Atlantic, a ice-raft and temperature proxy record (D; Bond, et al, 2001), and with potassium ion content in the GISP2 ice core, a proxy of the Siberian High (E; Mayewski, et al, 1997). The episodes of high hemateite-stained grain content are marked in sequence from #0-8. Shaded areas indicate periods of weak summer monsoon and thus dry climate events in the study area, and principle periods of strong Siberian High.

Summary:

- (1) At the monsoon margin of the south Mongolian plateau, our pollen results show three main stages during Holocene, i.e., the wet early Holocene (11.6-7.1 Cal ka), dry Mid-Holocene (7.1-3.8 Cal ka) and wet late Holocene (3.8-0 Cal ka).
- (2) Holocene climate in monsoon margin has the general millennial and centennial-scale humid variations, which are similar to rapid Holocene climate changes documented elsewhere and to those during last glacial.
- (3) The general strong dry climate lasting from ca 7000 to 5000 cal year was in the so-called mid-Holocene mega-thermal period in E. Asian Summer Monsoon Margin.

References

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