ISOTOPIC EVIDENCE FOR HOLOCENE CLIMATIC CHANGES IN BOSTEN LAKE, SOUTHERN XINJIANG, CHINA

Zhong Wei (~ ~) Xiong Heigang (~ ~)
Department of Geography, Xinjiang University, Urumqi 830046, P. R. China
(Received 21 July 1997)

ABSTRACT: Based on the 813C and 818O fluctuation of lacustrine carbonate, CaCO3 content and sporo-pollen data, a palaeoclimatic history of Bosten Lake during the Holocene has been outlined, several stages of climatic changes are divided, and the following results are obtained: (1) Palaeoclimatic changes revealed by carbonate isotope around Bosten Lake are basically identical with that revealed by other geological records in Xinjiang. Environmental changes presented apparent Westlies Style model; during cold period, relative humidity increased, 818O, 813C and CaCO3 appeared low; but in warm periods, the dry regime aggravated. (2) The temperature reflected by 818O exist evident features being increase in the late period during the Holocene. Together with the 813C, pollen and CaCO3 analyses, several cold and warm phases which are of broad regional significance can be identified. The warm peaks occurred at about 11.0 ka B.P., 9.4 ka B.P., 7.5 ka B.P., 5.0 ka B.P., 3.0 ka B.P. and 2.0 ka B.P.; the cold peaks at 11.5 ka B.P., 10.5 ka B.P., 8.8 ka B.P., 5.5 ka B.P., 3.3 ka B.P., 2.2 ka B.P. and 1.5 ka B.P.. (3) Several climatic events with the nature of "abrupt climatic changes" are revealed in the periods of 11.0 ka B.P. - 10.5 ka B.P., 9.4 ka B.P. - 8.8 ka B.P., 5.5 ka B.P. - 5.0 ka B.P. and 2.0 ka B.P. - 1.5 ka B.P.. (4) The results show that carbonate isotopic record of lacustrine sediment in arid area is very sensitive to climatic changes, and may play a very important role in understanding the features and mechanism of palaeoclimatic changes.

KEY WORDS: Bosten Lake, 818O of carbonate, 813C of carbonate, Holocene, climatic changes

1. INTRODUCTION

Bosten lake (86°40' – 87°26' E, 41°56' – 42°14' N), a lake of tectonic origin, is the largest inland freshwater Lake in China. It lies in the depression of the southern part of Yanqi Basin. The mean monthly temperature ranges from −9.2°C in January to 23.6°C in July, while the mean annual temperature and precipitation are about 6.3°C and 68.2 mm respectively. The ratio of evaporation to precipitation ranges between 26 and 30. Bosten Lake is very sensitive to
regional climatic changes because it supplied mainly by melting water from glaciers and snow in the Tianshan Mountains and tectonics have not significantly modified its hydrology in the late Quaternary. In an attempt to find Holocene lacustrine records, which is available to reconstruct the history of the Holocene climatic evolution in this area, an excavation was carried out in the site about 2 km southwest from Bohu County town, a pit was dug to 3.2 m. In this paper, we aim to use isotopic records of carbonate, spore-pollen data and CaCO$_3$ content to rebuilt the processes and features of climatic changes during the Holocene.

II. SAMPLING AND METHODS

The Holocene lacustrine sediment of Bosten Lake is characterized by green-grey, grey-black clay or silt clay and yellowish silt clay. Peatification layers have developed at 1.2 m, 1.6 m, 2.1 m and 2.8 m. Six samples were taken for $^{14}$C dating measurement, the results are shown in Fig. 1. Based on the mean deposit rate, chronologic sequence of this section can be constructed by age-intercalation.

![Fig. 1 Sedimentary feature and age-depth relation in the section of Bosten Lake](image)

Samples were collected for isotopic examination at 0.05 m intervals. Isotopic analysis methods presented herein are the same as that proposed by Wu Jinglu (1997). Fraction below 0.002 mm have been seperated by means of gravity-settling. By treatment with 100% H$_3$PO$_4$, the isotopic analysis of carbonate was performed on CO$_2$ prepared from the carbonate. Prior to analysis, samples were heated for 1 hour under vacuum at about 475°C to drive off any organic