CHINESE GEOGRAPHICAL SCIENCE
Volume 9, Number 1, pp. 92 - 95, 1999
Science Press, Beijing, China

THE RECORD OF YOUNGER DRYAS EVENT IN EOLIAN SAND DEPOSIT IN QAIDAM BASIN①

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(Received 3 June 1998)

ABSTRACT: The Qaidam Basin is one of the main areas where the desert of the Qinghai-Xizang Plateau is distributed. According to the environment records and the age of stratigraphy in Xiaxitai section in southeast part of Qaidam Basin, this paper reached the following conclusions: the desert development, formation of the cold-dry climate, evolution of natural environment and their reverse changes occurred frequently since the late glacial. In eolian sand deposits, the Younger Dryas event clearly appeared, which manifesed a dry-cold climatic period. Now there are two different opinions about the climatic effect of Younger Dryas. According to the predecessors' research and the field work of the authors, it is considered that the Younger Dryas event not only exists in different climatic zones of China, but also manifests the unitary dry-cold climatic effect.

KEY WORDS: Younger Dryas event, eolian sand deposit, Qaidam Basin

Dansgaard and others hold the view that severe climatic fluctuation in the late glacial is caused by adjustment of the North Atlantic current, which mainly affects the climate in the North Atlantic Ocean. But the reports about the Younger Dryas event found in various sediments of different places prove that Younger Dryas event is a climatic event over the globe rather than a region. In recent years there are many reports about Younger Dryas event found in marine and continental sediments of middle latitude in China. Now it is indubitable that the Younger Dryas event exists in China. But there are different opinions about its response model of climate in different natural zones of China. Through recent research about desert evolution in Qaidam Basin during the Late Pleistocene, it is firstly find that the Younger Dryas event is recorded clearly in eolian sand deposit in Qaidam Basin.

The Qaidam Basin is one of the areas where the deserts of the Qinghai-Xizang Plateau mainly are distributed. The deserts are distributed in the south margin and southeast part of Qaidam Basin, and the areas around the three lakes (east Taijinaier lake, west Taijinaier Lake and Dabuxun lake) in Qaidam Basin. According to the environment records and the age of stratigraphy in Xiaxitai section of southeast margin of Qaidam Basin, we studied the processes of the desert evolution and climatic events in this area.

1 THE FEATURES AND ENVIRONMENT RECORDS IN XIAXITAI SECTION

Xiaxitai section located at the margin of the Dulan-Tiekui desert in southeast part of the Qaidam Basin crops out in river terrace, which is a typical loess-

① This project was supported by the National Natural Science Foundation of China (No. 49361006). We thank Prof. Li Jijun for his direction.

eolian sand profile. From the top to the bottom, the profile can be divided into four units (Fig. 1). The main lithological characters are described as follows:

0 – 55 cm: sandy loess, light yellowish brown (10 YK 6/4);

55 – 80 cm: eolian sand, yellowish brown (10 YK 5/4); TL-date of the middle section is (11.36 ± 2.27) ka B. P.;

80 – 95 cm: sandy loess, light yellowish brown (10 YK 6/4);

95 – 150 cm: eolian sand, yellowish brown (10 YR 5/4); TL-date of the middle section is (22.20 ± 4.04) ka B. P..

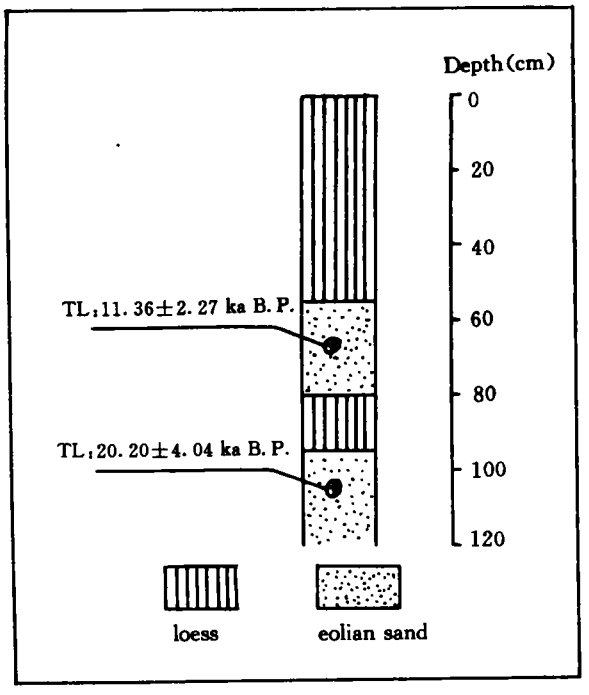

Fig. 1 Xiaxitai loess-eolian sand profile

Chinese loess and eolian sand deposits have been regarded as a well-preserved record of Quaternary climatic cycles and environmental evolution. Because sediment granu-larity is controlled by transportation exegetic forces, the changes of granularity in loess and eolian sand deposit indicate the strength and weakness at tropospheric wind force near the earth surface as well as the winter monsoon. So the granularity and composition of loess and eolian sand is regarded as proxy record of Asian monsoon variations and environmental evolution. It is applied to the researches of environmental variations in the Quaternary. This paper uses granularity as main environmental proxy record and analyses environmental information recorded in Xiaxitai loess eolian sand profile. A total of 19 samples have been collected from the Xiaxitai profile. The sampling interval is 5 cm. Two methods are used in grain size analysis of the samples. One is sieve analysis, which is used in >0.063 mm grain composition, the other is liquid inhaler, which is used in 0.063 mm grain composition. According to the results of grain size analysis in the profile, the grain-size is coarse and the mean grain-size is about 2.5 – 2.7 ø in upper and lower eolian sand sections. Because eolian sand in stratigraphy is an important mark, which indicates quick sand activity and desert development, two aeolian sand layers in Xiaxitai profile indicate two times of violent positive processes of desertification while the desert expanded, climate was cold-dry, the winter monsoon was strengthened, regional environment was worse and natural landscape assumed arid desert.

The loess in the profile are typical sandy loess, which is composed of fine sand (25.42%), extreme fine sand (64.2%) and clay (1.54%). The mean grain-size is about 4.2 ø. The two loess sections in the profile indicate two times of reversing processes of desertification taking place in this area during the late part of the late Pleistocene, which corresponded to the climatic changes from cold to warmness, the strengthening of summer monsoon, reduction of the shifting sand, desert shrinkage and fixation, regional environment change from arid desert to arid and semi-arid dry steppe and desert steppe.

2 CONCLUSIONS AND DISCUSSION

From vertical correlation of the Quaternary strata, it is found that eolian sand and loess deposits overlapped, which indicates the process of regional climatic changes and environmental evolution. In Xiaxitai

profile the sedimentary sequence of eolian sand and sandy loess overlapped, which indicates that the regional environment experienced a series of positive and reverse changes from the occurrence of shifting sand to the spread (developmental proccesses of desertification) and fixation and shrinkage of the shifting sand to grassland (reversing processes of desertification) and from the strengthening of cold-dry climate to getting slightly during the Late Pleistocene. At 11 ka B.P. regional environment worsened, which corresponded to the desert expansion, shifting sand spread, intensified desertification processes and winter monsoon, cold-dry climate and arid desert landscape The aeolian sand deposits in the profile during that time also indicates a dry-cold climatic event in Qaidam Basin during the late part of the Late Pleistocene, which took place in the same time with Younger Dryas event. So in eolian sand deposit of Qaidam Basin, the Younger Dryas event clearly appeared, which manifested a dry-cold climatic period.

According to the predecessors' research, the Younger Dryas event was recorded in loess, lake and glaciation deposits of different climatic zones in China, and was considered as a global climatic event. But now there are two different opinions about the climatic effect of Younger Dryas in different regions of China. According to the pattern of solar radiation intensity in Northern Hemisphere since 18 ka B. P. by Kutzbach *et al.*, An Zhisheng *et al.* (1993) proposed that solar radiation intensified and the summer monsoon intensified in Northern Hemisphere during Younger Dryas., and paleosol development and loess deposit interruption in Baxie loess section, just west of the Loess Plateau of China. Wang Sumin *et al.* (1994) found the records of Younger Dryas event in lacustrine deposition of Jalai Lake in Inner Mongolia and interpreted the Younger Dryas event indicating a warm and moist environment. But more and more researches have suggested that the Younger Dryas event manifested dry-cold climatic effect. Kelts *et al.* (1989) studied piston cores from Qinghai Lake and found the records of Younger Dryas event which indicated an episode of a cold, arid climate, rapid loess deposition and lake level drop. Evidences of a shift to drier conditions during Younger Dryas may be present in different depositions such as ice cores from the Dunde ice cap near the north margin of the Xizang Plateau(Thompson *et al.*, 1989), the Zepu glacier in south of Xizang (Li *et al.*, 1986) ,the Guliya ice cap on north Xizang Plateau (Jiao *et al.*, 1994), lacustrine depositions of the lakes in the North Qiangtag Plateau(Li, 1994), Lacustrine depositions of Aibi Lake in Xinjiang(Li, 1993) and Daihai Lake in Inner Mongolia, Baxie loess section (An *et al.*, 1991), peat section in desert/loess transitional zone(Zhou *et al.*, 1996), cores from Guchen Lake in Jiangsu (Wang *et al.*, 1996), and ice core in Greenland ice by GRIP. and GISP(Taylor *et al.*, 1993; Jonson *et al.*, 1993), All above results about Younger Dryas event is the same as in eolian sand deposit in Qaidam Basin. According to the predecessors' research, we concluded that there were the records of Younger Dryas event in different climatic zones of China such as glacier, lake, loess, desert deposits and it manifested dry-cold climatic effect which is more serious in west part of China. From seaside of the Yellow Sea to Qinghai-Xizang Plateau there were decrease of sea level, loess deposition, desert developing, lake shrinking and ice advance.

The authors firstly verifies that the Younger Dryas event clearly appeared in eolian sand deposits of the Qinghai-Xizang Plateau and manifests a dry-cold climatic period. The Younger Dryas event not only exists in different climatic zones of China, but also manifests the unitary dry-cold climatic effect. According to this conclusion, the severe climatic fluctuation of middle-high latitude in the Late Pleistocene is a phenomenon over the globe rather than a region, which has a significance to studying climatic changes in China as well as Asia.

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