

MILLENNIAL CLIMATIC VARIATIONS DOCUMENTED BY CARBON ISOTOPE OF ORGANIC MATTERS IN LAKE SEDIMENT IN THE ARID CHINA SINCE THE LAST DEGLACIAL

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The researches have been focusing extensively on the climatic variations at millennial to even short time scales in the world. It not only can construct regional and global climatic change models, but also understand well the tendency of climate in the past or future. The climatic variation information which abundance, succession and high-resolution has been recorded in detail in the lake sediments, especially the close lake in the arid or semiarid areas. So, the lake especially in the arid areas, and sediments are the focal point all along in the global climatic change researches. The ecological communities are complex in the lake where there are made of terrigenous C3 and C4 plants, hydrogenous emerged macrophytes, fungi, algae and others. The C3 and C4 photosynthetic different pathways result in distinct ^{13}C signatures, with characteristic, ^{13}C enriched values for the C4 pathway, and in this process of isotopic fraction the temperature is the significant. Comparing C3 with C4 grasses, the mild to warm (not hot) and humid climate resulted the growth of C3 plants, the arid climate was conducive to the C4 plants. We use the carbon isotopic compositions of organic matters in the sediment to reconstruct the history of the palaeoclimatic changes. Combining with the sedimentary texture to judge the palaeoenvironment, we selected the research object, a fluvial lake that is a river in the mild-humid climate and plentiful water, there's a little organic matter content and favoring C3 plants in this period, and a lake in the arid climate because of decreasing river consumption and prevailing emerged macrophytes to C4 plants from water environment to extinct lake, there's a higher organic matter content. A 7m depth section of exploratory well at the Shangjiaocheng, $103^{\circ}20.29'\text{E}$, $38^{\circ}59.10'\text{N}$, 1325m elevation, of Shiyang River drainage in Minqin Basin of the arid China, Gansu province, was selected to recover the history of climatic change in this area. Shiyang River drainage in the arid China located in the transition belt among Tibet, Loess and Mongolia Plateau where climatic variation is sensitive. The lake sediments have recorded climatic variation data since the last deglacial. A chronological sequence is established based on some radiocarbon dates. The sedimentary ratio was about 0.05cm/a. Organic matter contents and carbon isotopic compositions determined by taken a sample each 2cm in this section. The results show lowering organic matters and organic $\delta^{13}\text{C}$ average of -25.4% in the silt and sand, but in clay higher organic matter content and organic $\delta^{13}\text{C}$ average of -23.9% . The more the content of organic matters, the heavier the carbon isotopic compositions. The relation between of them is apparent. It's concluded based on the palaeoenvironment and carbon isotopic compositions that organic matters in silt and sand mainly came from C3 plants, and in clay mainly came from emerged macrophytes and C4 plants. Comparing these two cases, the preceding belonged mild-humid climate and higher river consumption, but the latter was arid climate and lower river consumption, Favoring of growth emerged macrophytes in the lake, predominating C4 plants in the extinct lake. That's means the heavier carbon isotopic composition, the arider the climate. The results indicate that a drier climate prevailed in this area during Holocene. It's showed that there are different climatic forms with the Tibet Plateau in this arid area. Carbon isotopic compositions reflect climatic changes at millennial even centennial scale. In the determined 0-110cm depth, organic matter carbon isotopic compositions in the sediment at the situations 32cm, 88-90cm, 98-100cm and 104cm

respectively are -22.9‰ , -21.2‰ — -23.3‰ , -18.2‰ — -22.3‰ and -22.0‰ . It's showed that organic matters came from emerged macrophytes and C4 plants and there were 4 arider climate events in which aridest in 1620-1650aBP. So the organic matter in the arid area lake sediment carbon isotopic composition is a proxy of arid climatic changes.