

A paleoclimate record of the late Pleistocene stalagmite from the Qixing cave, China

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Method

On the basis of the measurement by using thermal ionization mass spectrometry-U series method, the ages of the stalagmite from the Qixing Cave (26°4'N, 107°16'E), China ranged in 43.02±0.96~12.65±0.29 KaB.P., corresponding to MIS2 and the late of MIS3.

Discussion of results

The oxygen isotopic variability of the stalagmite revealed that the paleoclimatic changes can be divided into three stages: in the first stage (43.02~29.60 KaB.P.), corresponding to the late of MIS3, the $\delta^{18}\text{O}$ values were generally lower than the average, and the climate was warm-wet and much rainy, which was agreement with the background of the low pressure in the Qinghai-Xizang Plateau and the large amount of the vapor from Bengal bay into this areas by the driving force of the Indian monsoon; in the second stage (29.60~14.60 KaB.P.), corresponding to MIS2, the $\delta^{18}\text{O}$ values were higher than the average, and the climate was cold-dry and less rainy, which was consistent to the background of the maximum stage of the last glacial period; in the third stage 14.60~12.65 KaB.P., corresponding to the late of MIS2 and the early of MIS1, the $\delta^{18}\text{O}$ values were just lower than the average, and the paleoclimate was getting warm-wet. As compared to the records of the Greenland oxygen isotopes (GISP2), the $\delta^{18}\text{O}$ values of the Qixing stalagmite showed that the Heinrich events 1,2,3,4 and Dansgaard-Oeschger IS1-IS11 warm events had been also recorded in the growth period of the stalagmite.

Conclusions

Currently, the thermohaline circulation is the major one of the driving mechanisms to be used for the explanation of the climatic oscillations in high latitudes. However, it was not only influence on the North Atlantic climate as so called a contral switch, but also affected to the global climate, in particular to air temperature and precipitation in many areas during the process of atmosphere dynamics. In fact, the paleoclimatic records in the Qixing stalagmite indicated that the Heinrich events and D-O cycles were provided with the global behavior and could also be found in low latitudes, such as in the South-West China.

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Determination of true fractional calcium absorption by thermal ionization mass spectrometry

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True Fractional Calcium Absorption (TFCA) is the proportion of Ca absorbed in human body from diet. It could be measured with double stable isotope tracers (one orally and one intravenously) and a thermal ionisation mass spectrometer. Ca isotopic ratio changes in urine were determined by TIMS, TFCA could be calculated according to the equation refer to Yergey (1987). ^{42}Ca (intravenous) and ^{44}Ca (oral) were used in 30 children with 14 old in this study.

Experiment

Tracers were first changed into CaCl_2 before oral and intravenous. Total 20mg ^{44}Ca were oral at equal fractions at 3 times in a day. About 2mg ^{42}Ca were intravenous once. Urine samples in 24-48 hours after test were received.

Urine calcium samples were purified with an oxalate precipitation method 2mL urine sample was mixed with 2 mL of saturated alkaline ammonium oxalate solution to precipitate Ca oxalate.

Ca isotopic ratios were determined by a thermal ionisation mass spectrometer (Finnigan MAT-262). Double filaments and peak jumping model were used. Natural $^{43}\text{Ca}/^{48}\text{Ca}$ ratio was used as reference value to correct Ca isotopic mass fractionation. when filament temperature at 1250-1350°, Ca isotopic ratios were determined.

Discussion of Results

TFCA scales of 30sample was large, from 45.11% to 100%, correspond with 17-100% of other researchers^[1-3]. There were 4 samples with more than 90%. That meant that chemical and TIMS measure procedure were reliable from another aspect. If there were some normal calcium pollution in experiment, it was impossible to get more than 90% of TFCA. This technique has high accurate and reliable security, may be applied in infants, children, pregnant and lactating woman, who need to understand Ca absorption.

References

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