QUANTITATIVE PALAEOENVIRONMENTAL RECONSTRUCTIONS ON CONTINENTS BASED ON ^{13}C AND ^{18}O ISOTOPE COMPOSITION OF LACUSTRINE CALCITE

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Further development of global models of evolution of climate is limited by the availability of adequate calibration data. Instrumental records of basic climatic parameters (surface air temperature, precipitation amount, relative humidity of the atmosphere, etc.) are relatively short and do not cover periods of major climatic shifts. Thus, there is a growing need for high-resolution, quantitative reconstructions of past climates, particularly over the continents, which could serve as high-quality calibration data for global climatic models. Lacustrine deposits represent one of the most promising archives of palaeoclimatic and palaeoenvironmental changes on continents.

The ^{13}C and ^{18}O isotope compositions of lacustrine calcite have long been considered a powerful tool to assess past climatic changes on continents. In spite of a large number of studies dealing with isotopic composition of lacustrine carbonates, the interpretation was in most cases qualitative, often relying only on temperature dependence of the ^{18}O equilibrium fractionation factor between dissolved carbonates and precipitating calcite and/or strong kinetic effect for ^{13}C during CO_2 uptake by phytoplankton. To fully explore the potential of these important climatic proxy indicators, a comprehensive, quantitative approach is required. This includes systematic studies of the processes controlling ^{13}C and ^{18}O isotope composition of precipitating carbonates in modern lacustrine systems, combined with quantitative modelling of these processes.

The paper reviews the mechanisms controlling isotopic composition of authigenic calcite for lacustrine systems located in various climatic settings and operating under contrasting hydrological conditions (through-flow lakes and terminal lakes). An attempt is presented to model both $\delta^{18}O$ and $\delta^{13}C$ of lacustrine calcite over time intervals comparable with the age of the given lake system, under varying climatic and environmental boundary conditions. The model results are tested against extensive set of data available for Lake Gosciaz located in central Poland. The data available for this system are related to both the present-day conditions of calcite formation in this system (Wachniew & Rozanski, in print) as well as the information stored in the sedimentary column of this lake. The laminated sediments of Lake Gosciaz cover the last 13 thousands years (Goslar et al., 1995) and contain a detailed record of palaeoclimatic changes in central Europe over this time period.