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A record of Pleistocene climate from a stalactite, Nerja Cave, southern Spain

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Abstract

A study of stable isotopes ($\delta^{18}O$, $\delta^{13}C$) of a uranium-series dated aragonitic stalactite from Nerja Cave (Málaga, southern Spain) was carried out in order to determine the conditions of deposition in isotopic equilibrium and non-equilibrium. We obtained a record of climate change from 190 000 to 160 000 years ago. A series of carbon ($\delta^{13}C$) and oxygen ($\delta^{18}O$) isotopes analyses have been carried out in parallel to the stalactite growth axis. Sampling was done in each growth layer. A curve of the secular $\delta^{18}O$ aragonite variations for the stalactite suggests cooler climate conditions in southern Spain for the period studied compared to the present.

Keywords: palaeoclimate; Pleistocene; south Spain; speleothem; stable isotopes

1. Introduction

Carbonate rocks are subject to dissolution by groundwater-forming karstic features ranging in size from microscopic vugs to passages tens or hundreds of kilometres in length. The advantage of caves for palaeoclimatic studies is the yearly stability of climatic conditions within most of them. Studies have suggested that the oxygen isotopic composition of cave dripwater is constant through the year, and approximately equal to the mean annual precipitation outside the cave (Schwarcz et al., 1976; Yonge et al., 1985). In addition, the common observation that temperature in any deep cave is close to the mean annual temperature aboveground (Wigley and Brown, 1976) provides the fundamental principle on which palaeoclimatic studies on speleothems are based. Dorale et al. (1992), Bar-Matthews et al. (1999, 2000), Williams et al. (1999), Linge et al. (2001a,b) among others, have demonstrated the possibility of using speleothems (including stalactites, stalagmites) for palaeoclimatic reconstruction. Studies of stalactites can provide highly resolved information on climatic and environmental cycles in continental regions (Harmon et al., 1978a,b; Reyes et al., 1993).

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