



Climatic variability during the penultimate interglacial (MIS 7) and glacial (MIS 6) periods recorded in a speleothem from Kanaan cave, Lebanon (Central Levant)

Carole Nehme (1), Sophie Verheyden (2), Sebastian F.M. Breitenbach (3), David P. Gillikin (4), Anouk Verheyden (4), Hai Cheng (5), Laurence Edwards (5), John Hellstrom (6), Stephen R. Noble (7), Andrew R. Farrant (8), Diana Sahy (8), Thomas Goovaerts (9), Ghada Salem (10), and Philippe Claeys (11)

(1) University of Rouen, Geography Department, IDEES Laboratory UMR 6266 CNRS, Mont Saint Aignan, France (carole.nehme@univ-rouen.fr), (2) Department of Earth & History of Life, Royal Institute of Natural Sciences (RBINS), Brussels, Belgium, (3) Sediment & Isotope Geology Institute of Geology, Mineralogy & Geophysics, Ruhr-Universität, Bochum, Germany, (4) Department of Geology, Union College, Schenectady, NY 12308 USA, (5) Department of Earth Sciences, University of Minnesota, Minneapolis MN 55455, USA, (6) Geochemistry Laboratory, Earth Science Department, University of Melbourne, Melbourne, Australia, (7) NERC Isotope Geosciences Laboratory, Keyworth, Nottingham, NG12 5GG, UK, (8) British Geological Survey, Keyworth, Nottingham, NG12 5GG, UK, (9) Geological Survey of Belgium, Royal Belgian Institute of Natural Sciences (RBINS), Brussels, Belgium, (10) ALES, Association Libanaise d'Etudes speleologiques, Mansourieh El-Matn Lebanon, (11) Analytical, Environmental & Geo-Chemistry, Department of Chemistry, Faculty of Sciences, Vrije Universiteit Brussel, Brussels, Belgium

Little is known about terrestrial climate dynamics of the Levant during the penultimate interglacial-glacial period. A well-dated stalagmite (~194 to ~154 ka) from Kanaan cave, located near the Mediterranean in Lebanon, is examined for its petrography, growth history, and stable isotope geochemistry to answer the climate instability pattern of the glacial MIS 6 and possible wet phases. A highly resolved continental climate record from the northern Levant has been recovered from this precisely U–Th-dated speleothem, spanning the late penultimate interglacial (equivalent of the MIS 7) to the mid-penultimate glacial period (~MIS 6). The stalagmite grew slowly and discontinuously with an unstable isotopic pattern from ~194 and at least up to ~178 ka. Subsequently, the stalagmite ceased growing from 169.5 to 163.1 ka (interpolated ages) with a hiatus of ca. 6.24 ka according to the model age. However, low $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ values indicate generally cold, but overall more humid climate compared to the last glacial (MIS 3). Higher growth rates during the mid-penultimate glacial period (~163–154 ka) are most probably linked to increased water recharge in the vadose zone. A short More distinct layering in the upper section compared to the basal part of the stalagmite suggests stronger seasonality from ~163 ka to ~154 ka. Negative oxygen and carbon isotope excursions were found at ~155.5 ka, ~156 ka, between ~159.6 and ~160.1 ka and at ~162.6 ka. The inferred Kanaan cave humid intervals during the mid-penultimate period follow variations of pollen records in the Eastern and Western Mediterranean basins and correlate well with the synthetic Greenland records and East Asian Summer Monsoon Interstadials, indicating short warm/wet periods similar to the D-O events during MIS 4–3 in the Eastern Mediterranean region.