



Vegetation responses to climate changes during the penultimate glacial period (marine isotope stage 6) in southern Europe

Katy Roucoux (1), V. Margari (2), I.T. Lawson (1), and P.C. Tzedakis (2)

(1) School of Geography, University of Leeds, Leeds, LS2 9JT, U.K. (k.roucoux@leeds.ac.uk), (2) Pearson Building, UCL Department of Geography, University College London, Gower Street, London, WC1E 6BT, UK

Like the last glacial, the penultimate glacial interval (MIS 6, 185,000 to 132,000 years before present) was characterised by increasing continental ice volume and decreasing concentrations of atmospheric greenhouse gases. However, greater orbital eccentricity during MIS 6 resulted in precessional-scale insolation changes of higher amplitude. This led to some unexpected combinations of climatic boundary conditions such as the high northern hemisphere summer insolation but relatively large ice volume and low atmospheric carbon dioxide concentrations of marine isotopic event 6.5. Records of regional climatic responses to different combinations of climatic forcing factors, in the form of pollen records of vegetation change, can contribute to our understanding of which factors determine conditions at the Earth's surface. Few palaeoecological records cover the penultimate glacial in detail and hence environmental and climatic responses during this interval are not yet well known. At Lake Ioannina, NW Greece, records of the last two glacial intervals are preserved at the same site enabling comparisons of vegetation responses to be made between periods with differing orbital configurations while keeping site variables constant. Our new palynological record spans the penultimate glacial interval at centennial scale resolution and represents the most detailed terrestrial record of this interval to date. Vegetation development throughout the glacial period indicates long-term cooling and drying reflecting the overall decline of northern hemisphere summer insolation and accumulation of large-northern hemisphere ice sheets, as expected. Conditions in NW Greece at the penultimate glacial maximum (PGM) appear to have been colder and drier than during the Last Glacial Maximum, consistent with records of lower Mediterranean sea surface temperature and greater extent of the European ice sheet at the PGM. During the early part of MIS 6, however, it appears that the high amplitude changes in insolation are not translated into high amplitude changes in vegetation and climate at Ioannina. Millennial-scale expansions and contractions of tree populations indicative of oscillations in temperature and moisture availability are recorded but they appear to have been more subdued than their counterparts during the last glacial. This supports the presence of non-linearity in the link between orbital-scale insolation forcing and regional climate.