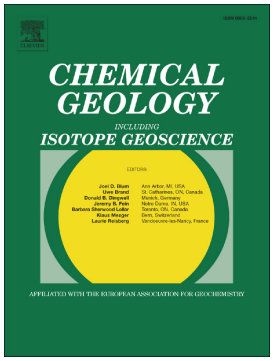

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Short-lived juvenile effects observed in stable carbon and oxygen isotopes of UK oak trees and historic building timbers.

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Abstract

Stable carbon ($\delta^{13}C$) and oxygen ($\delta^{18}O$) isotope ratios were measured on the latewood α-cellulose of individual oak (*Quercus robur* L, *Q. petraea* Liebl.) samples from living trees and historic building timbers. This represents the type of material available to produce long tree-ring chronologies for north-western Europe including the UK and Ireland. Results from the juvenile rings, those located closest to the pith, were compared with results from equivalent sections (representing the same calendar years) from independent master isotope chronologies that do not contain any juvenile wood, allowing any juvenile offsets and trends to be separated from those caused by environmental change. Oak timbers from archaeological sources are often relatively short (<100 years). Therefore, removing the first 50 rings, as is typical for *Pinus* sp., would severely constrain the material available for chronology construction. The aim of this study was to determine the magnitude and duration of juvenile effects, including the detection of trends, offsets and their influence upon signal strength. The results show clearly that juvenile effects for oak from central England are very small and short-lived and that removing merely the first five rings closest to the pith is sufficient to avoid them. This result greatly increases the potential for building long and well-replicated stable isotope chronologies using archived oak samples from historic building timbers, allowing high-resolution climate reconstructions to be produced for the highly-populated regions, where oak is abundant and which are currently under-represented in regional palaeoclimate reconstructions.

Keywords

Tree rings; stable isotopes; dendrochronology; dendroarchaeology; *Quercus*; non-climatic trends