DATING THE PAST USING STABLE ISOTOPES IN TREE RINGS

Our research team specialises in using tree-rings not just for reconstructing the climate of the past, but also for dating historic timbers and wooden artefacts. We do not only use ring widths, but have developed a new approach based upon the chemistry of the wood.

By measuring the stable (non-radioactive) isotopes of carbon and oxygen preserved within each individual tree ring it is possible to use the chemical "fingerprint" of the sample for dating. The carbon isotopes vary mainly in response to the amount of summer sunshine and the oxygen isotopes to summer rainfall.

Using special corers we remove samples from living trees and old buildings. Sampling does not cause untoward harm to the trees or damage the buildings. Often, we collect samples from structures under archaeological investigation to establish their age and construction history. For very old timbers, many hundreds or thousands of years old, we can sample logs preserved in peat bogs and sediments.

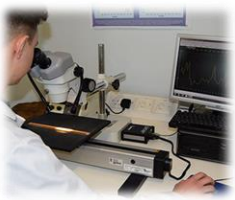
We then carefully clean the wood and remove each tree ring using a scalpel. We chemically extract the cellulose from the wood and then pyrolise each individual sample at 1400˚C which converts it to carbon monoxide (CO) gas. We then analyse the stable isotopes in the CO gas using an isotope ratio mass spectrometer.

To date a sample we compare the year-to-year changes in the isotope data against a unique reference chronology. The point in time where the sample and reference series match most strongly and with high statistical significance fixes the chronology in time and provides a date of the sample.

Of course, this method does not date the construction of the historic building or artefact, but where bark (or bark edge) is present we can report a date for the last ring formed by the tree before it was felled. In the past, timbers were often used unseasoned and within 12-18 months of felling, and so a precise date for the last ring measured can be very informative to historians, heritage managers and archaeologists.

The isotopic match between trees is much stronger than for ring widths and importantly does not require the trees to be physiologically stressed to record a dating signal in their ring. This opens-up new research opportunities across the UK and means that it is now possible to use isotopic variability to date wood samples from fast-growing trees with short, invariant ring widths that would not normally be dated using conventional ring width dendrochronology.



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Preparation of an isotope record is an exacting task requiring the collection of samples from old trees, lakes and historic buildings, dissection of the individual tree-rings, chemical purification to cellulose, isotope ratio mass spectrometry and statistical analyses.

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