UV-laser microdissection system - A novel approach for the preparation of high-resolution stable isotope records (δ^{13}C/δ^{18}O) from tree rings

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Intra-annual stable isotope (δ^{13}C and δ^{18}O) studies of tree rings at various incremental resolutions have been attempting to extract valuable seasonal climatic and environmental information or assessing plant ecophysiological processes. For preparing high-resolution isotope samples normally wood segments or cores are mechanically divided in radial direction or cut in tangential direction. After mechanical dissection, wood samples are ground to a fine powder and either cellulose is extracted or bulk wood samples are analyzed. Here, we present a novel approach for the preparation of high-resolution stable isotope records from tree rings using an UV-laser microdissection system. Firstly, tree-ring cellulose is directly extracted from wholewood cross-sections largely leaving the wood anatomical structure intact and saving time as compared to the classical procedure. Secondly, micro-samples from cellulose cross-sections are dissected with an UV-Laser dissection microscope. Tissues of interest from cellulose cross-sections are identified and marked precisely with a screen-pen and dissected via an UV-laser beam. Dissected cellulose segments were automatically collected in capsules and are prepared for stable isotope (δ^{13}C and δ^{18}O) analysis. The new techniques facilitate inter- and intra-annual isotope analysis on tree-ring and open various possibilities for comparisons with wood anatomy in plant eco-physiological studies. We describe the design and the handling of this novel methodology and discuss advantages and constraints given by the example of intra-annual oxygen isotope analysis on tropical trees.