



Comparison of $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ from cellulose, whole wood, and resin-free whole wood from an old high elevation *Pinus uncinata* in the Spanish central Pyrenees*

Dana F. C. Riechelmann^{a,b}, Michael Maus^b, Willi Dindorf^{c,†}, Oliver Konter^a, Bernd R. Schöne^b and Jan Esper^a

^aInstitute of Geography, Johannes Gutenberg-University Mainz, Mainz, Germany; ^bInstitute of Geosciences, Johannes Gutenberg-University Mainz, Mainz, Germany; ^cInstitute of Organic Chemistry, Johannes Gutenberg-University Mainz, Mainz, Germany

ABSTRACT

$\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values from sapwood of a single *Pinus uncinata* tree, from a high elevation site in the Spanish Pyrenees, were determined to evaluate the differences between whole wood and resin-free whole wood. This issue is addressed for the first time with *P. uncinata* over a 38-year long period. Results are also compared with published isotope values of α -cellulose samples from the same tree. The differences in $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ between whole wood and resin-free whole wood vary within the analytical uncertainty of 0.3 and 0.5 ‰, respectively, indicating that resin extraction is not necessary for sapwood of *P. uncinata*. Mean differences between cellulose and whole wood are 0.9 ‰ ($\delta^{13}\text{C}$) and 5.0 ‰ ($\delta^{18}\text{O}$), respectively. However, further analyses of different species and other sites are needed to evaluate whether the findings reported here are coherent more generally.

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1. Introduction

An increasing number of studies employ stable carbon and oxygen isotope values from tree-rings as climate proxies [1–9]. Most of these studies determined $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values of α -cellulose in tree-rings. Furthermore, isotope signatures of whole wood and lignin were also measured and compared to those of α -cellulose [10–16]. Due to the time-consuming extraction of α -cellulose from tree-rings, whole wood was tested in several studies for its applicability as a climate proxy. According to the results of existing studies, cellulose shows higher $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values than contemporaneously formed whole wood [10–12,14,15]. However, $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values of whole wood and cellulose seem to cohere well at inter-annual (high-frequency) timescales [11,12,14,17,18].

Several studies analysed and compared the isotopic compositions of the different wood components. Sidorova et al. [10] found significantly varying isotope residuals between cellulose and whole wood over longer timescales. Other work revealed differing climate

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†Deceased

CONTACT Dana F. C. Riechelmann riechelmann@uni-mainz.de