Effects of oxygenated carbonization on the isotope signal in tree rings. Implication for ancient charcoals.

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Stable isotope composition of plants is known to be influenced by environmental conditions. Plant $\delta^{13}C$ values strongly depend on water availability and to a lower extent on irradiance and temperature. The isotope composition of ancient plant remains is thus widely used to reconstruct past environments. Tree ring width is also a powerful indicator of environmental growth conditions. When applied to tree rings, isotope studies in combination with tree ring width allow detailed reconstructions of fine climatic variations. Charcoal fragments are among the most frequent plant remains in the sediment record and, despite fragmentation, carbonization does not alter growth ring organization of original wood. The isotope characterization of charcoals at the ring scale, integrating tree-ring width, potentially represents a powerful tool to document past climates as far as carbonized wood isotope composition is not significantly affected by diagenesis.

However, the effect of carbonization on wood isotope composition is poorly documented and not investigated at the ring scale. The aim of the present study was thus to investigate, at the growth ring scale, the effect of carbonization in oxygenated conditions on the $\delta^{13}C$ signal of wood in order to better constrain of the isotope signal of ancient charcoals.

A fully monitored open fire was designed to carbonize wood fragments in reproducible conditions. Individual growth rings were sampled before and after carbonization, and analyzed for their stable carbon isotope composition. This first approach focuses on a single taxon, the deciduous oak (*Quercus f.c*), as it can be considered as representative of European temperate forests and anthracological spectra. Preliminary results obtained at 680°C show shifts in $\delta^{13}C$ varying from -3.5 to +1.3‰ between uncharred and charred wood. These shifts are higher than those previously reported. Indeed, previous experimentations, that were mainly achieved in muffle furnace and/or in anoxic conditions, led to insignificant variations or lower than -1.5‰. However in natural fires a large range of temperature may occur. As a result, experiments are under progress at lower temperatures to allow a better understanding of charcoals $\delta^{13}C$ values.

To test whether the potentially high effects of carbonization preclude the use of isotope composition of ancient charcoals to reconstruct past environments, we investigated archeological charcoals at ring scale coming from well documented and contrasted environments. Preliminary data show that coals from wetter and colder climate and from dryer and warmer appeared well separated on a $\delta^{13}C$ vs ring width plot. These results suggest that environmental variations can be recorded by the combined ring width and ring $\delta^{13}C$ values of archeological charcoals in temperate climate. They also suggest that carbonization in open domestic fires does not preclude paleoenvironmental reconstruction based on growth ring width and $\delta^{13}C$.