



## **The role of climate in early agrarian societies (4900-4300 calBC) in the Rhineland/West Germany based on stable isotope analysis of tree rings**

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The Neolithic Revolution, i.e. the beginning of food production, in the Fertile Crescent at the start of the Holocene, marks a fundamental change in human subsistence and history in general. From its origin in the Middle East, this mode of subsistence spread to Europe, reaching the Rhineland at about 5300 calBC. During the first millennium after its arrival, particularly from 4900 calBC onwards, the archaeological record reflects changes in the material culture, settlement patterns and the agricultural system (e.g. introduction of new crops).

The aim of our project is to contribute to answering the question whether these changes were caused by external factors, like climate variation or by internal stimuli like changing cultural preferences in diet. In order to evaluate the role of climate as an external factor, we performed stable isotope measurements ( $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$ ) on tree-ring cellulose of waterlogged oak timbers from the opencast lignite mining in the lower Rhine Basin (Kaster) and from gravel pit activities near the River Weser in Lower Saxony (Fischbeck). These timbers have been dendrochronologically dated in the early 1970s at the Dendrolab of the University of Cologne and archived after for more than 40 years, where they dried out slowly. For the current study, ring widths were remeasured for early- and latewood separately. Since variations in ring width of both sites do not correlate, two different tree-ring master chronologies were used for absolute dating. Additionally, six of these timbers, five from Fischbeck and one from Kaster, were selected for stable isotope analysis of latewood. In total, we will present 615 isotope measurements covering the period from 4599 to 4416 calBC.

In our presentation we will discuss i) common/independent variability of the stable isotope time series of both sites, ii) the potential/limitations of applying stable isotopes for crossdating, and iii) the influence of environmental factors on growth and tree-ring isotope fixation at our sites. Besides we also face the question how different ways of preservation and storage may influence wood quality and could potentially bias stable isotope analysis. Additionally, independent archaeological proxy data will be compared to the results of the tree-ring analyses in order to detect potential responses of early agrarian societies to climatic variation.