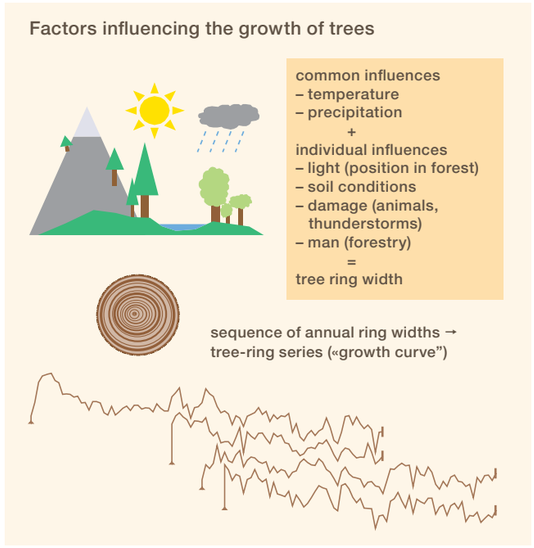

More than just a date

Even with the reconstruction of house floor plans and settlement sequences or the dating of historical buildings, the information potential of the tree rings is far from exhausted. For example, the age structure and growth patterns of the large number of dated timbers from prehistoric pile dwellings provide information on the development of the use of construction timber. On the shores of Lake Biel there is thus evidence of targeted forest management as far back as 5000 years ago.

Further conclusions can also be drawn for medieval and modern forest use. Due to population growth, good construction timber became a scarce resource in many places, so that it sometimes had to be imported from afar. A comparison of the tree ring patterns with different regional references provides indications of the possible origin of the trees.

Dendrochronology is also of fundamental importance for climate research. Dated tree trunks embedded in old moraines provide information about past glacier advances and thus about climatic developments. The long tree-ring sequences also help climate researchers to reconstruct the temperature and precipitation fluctuations of past millennia.

Requirements for successful dating

In principle, the tree rings of any well-preserved wood can be measured. The longer the tree-ring sequence, the greater the probability that the exact same pattern can be found within the reference chronology. Oaks and coniferous trees yield the best dating results. They have always been preferred for timber and we now have extensive reference chronologies for these species.

In addition to weather and location, the growth of each tree is influenced by other factors and no two ring patterns are exactly the same. Although this makes it difficult to date a single piece of wood, it allows conclusions to be drawn on the individual growth conditions of each tree.

Therefore, whenever possible, several samples from the same site or construction phase of a building should be examined. These pieces of wood will have come from the same forest and their growth curves are thus most likely to match each other. The individual growth fluctuations are smoothed out in the resulting mean curve and the common weather signal, which is important for dating, comes to the fore.

Former coppiced wood consisting of mainly oaks and hornbeams. The trees are felled to a “stool”, thus promoting fast-growing new shoots, which produce good construction and fire wood. This form of forestry already occurs in the Neolithic period.

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Services: The dendrochronological laboratory of the Archaeological Service of Canton Bern in the “von Rütte-Gut” in Sutz-Lattrigen is happy to make its services available to other institutions and private individuals. Further information is available at: adb.dendrochronologie@be.ch.

Bibliography: Matthias Bolliger, Dendrochronologie. Geschichte und Anwendungsbereiche. Mitteilungen der Naturforschenden Gesellschaft in Bern, Neue Folge 75, 2018, 40–59. – John Francuz, Zur Entwicklung der Dendrochronologie am Bielersee 1978–2014. Archäologie Bern / Archéologie bernoise 2018. Bern 2018, 242–267.

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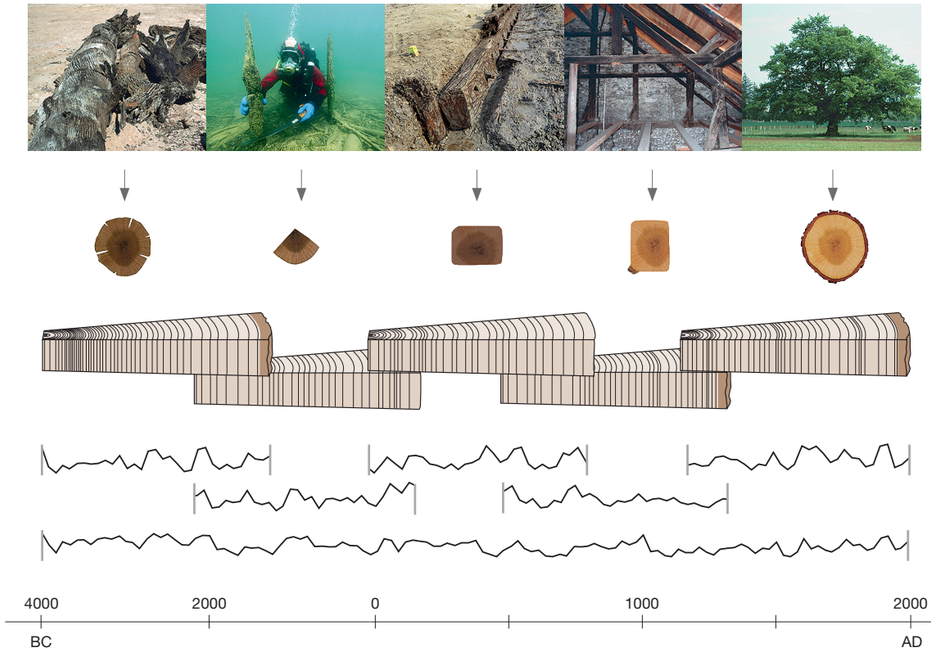
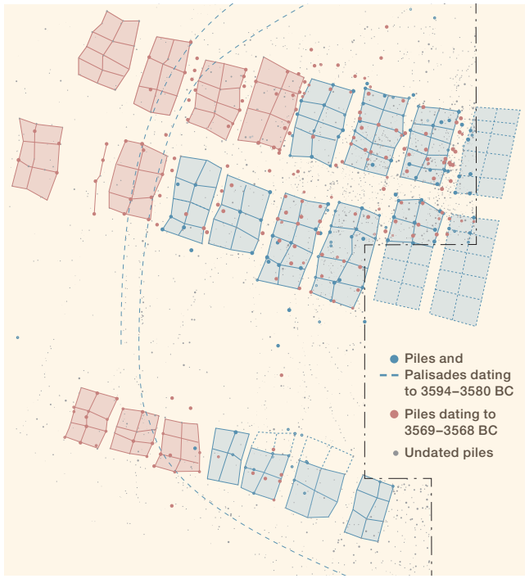
6 / 2021

Canton Bern

Dendrochronology



A reference chronology consists of numerous woods from historical houses, Roman building remains, pile dwellings or tree trunks from river gravel or bogs. Through overlapping of increasingly older pieces of wood, a complete sequence of tree ring widths has been created which, in the case of oak for Central Europe, dates back 10,000 years into the past.



Detail of a pile field in Sutz-Lattrigen. Thanks to the piles, which are dated to the exact year, it is possible to identify the house plans and the expansion of the settlement.

Wood sampling in Burgdorf Castle. The trees for the massive ceiling beams of spruce and silver fir were felled in 1200 AD, worked into shape and probably used shortly afterwards.

Increment cores for tree ring measurement. Above: oak from Fraubrunnen, felled 1700 AD; below: spruce from Adelboden, felled in 1631 AD.

Oak pile from the excavation at Biel, Campus. The tree was felled and split in 3840 BC.

Dendrochronology

Dendrochronology is a method that can be used to determine the exact felling year of a tree. It is an integral part of archaeological investigations and provides information on the history of construction, settlement dynamics, forest use and climate history. Since the late 1970s, dendrochronology has been applied and further developed in the Archaeological Service of the Canton Bern, from 1988 onwards in its own laboratory.

In our latitudes, each tree forms one growth ring per year. The annual growth depends primarily on the weather and the site. In years with favourable growth conditions a wide ring is formed, in unfavourable years a narrower one. The weather influences all trees in a region to a similar extent, so that their tree-ring series are similar as well. Thanks to these growth patterns, reference chronologies can be created far back into the past (see figure above).

Whether wood is recovered on an archaeological excavation, in the gravel of an old riverbed or during a survey of a historical building, the sequences of the annual ring widths can be measured under the microscope in the laboratory and compared statistically and visually with existing reference series. In the case of a matching pattern of the tree-ring series, the wood is dated. If the last ring formed by the tree, the so-called waney edge, is preserved, even the exact year of the tree's felling can be determined.

Dendrochronology in practice

Dendrochronology can be used to date wood from all eras, from prehistoric pile dwellings to modern buildings. In the Neolithic period and the Bronze Age, for centuries, settlements were built at the same sites on the lakesides of the Canton of Bern. Thousands of piles have been preserved due to the good conservation conditions of the waterlogged environment. However, the ground plans of the buildings are hard to recognise in the dense pile fields. It is only with the accurate dating of the piles that wood felled at the same time can be identified and coherent structures can be joined up. In this way, it is possible to reconstruct plans of houses as well as later repairs, the expansion of villages or even settlements sequences. When combined with the finds, structures and other scientific methods, insights into the everyday life of people of up to 6000 years ago can be gained. It is thanks to this important data basis, that in 2011 the "Prehistoric Lake Dwellings around the Alps" – spanning 111 selected archaeological sites from six countries – was inscribed on the Unesco World Heritage list.

Dendrochronology is also employed to date historical buildings such as castles, farms, churches, bridges and townhouses. With a small hollow drill, cores are extracted from structural timbers in the buildings. Their tree-ring series can then be measured.

A large number of local reference chronologies are now available for dating. Many a building has revealed its centuries-old history only after a dendrochronological investigation was carried out. Individual objects such as musical instruments, furniture or picture panels can also be dated thanks to dendrochronology.