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Protocol for fir tree sampling for provenance studies

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Isotopic (stable and radiogenic) as well as trace element fingerprinting methods used for tracing the geographical origin, rely on databases, that need to contain data sets representative of the measurands of the individual samples for a specific geographic entity. Through this work, we want to assess different sampling strategies for obtaining representative sample of fir trees (Abies sp.). Motivation for this work is the protection of the local Austrian Christmas tree market from wrongly tagged trees of non-Austrian origin. In particular, we studied three typical Christmas trees the most common species sold as Christmas tree, namely Abies nordmanniana (Nordmann Fir), from the same locality in lower Austria.

For the initial tests we applied the elemental fingerprinting method, to study the suitability of the different parts of the tree applying ICP-MS analysis after complete acid digestion in a high pressure asher system (HPA-S).Needle samples from each year of life of the tree and stem wood from three different heights were analyzed for their trace element content to prove the repeatability and to find the best sampling protocol. For the analysis of the needles, the natural wax coating had to be removed in order to get reproducible results. For the analysis of stem wood only the bark was removed.

As expected the data of all three trees allowed the differentiation of the individual needle ages, but interestingly enough also between the three sampling heights of the needs. Both needles and wood proved to be suitable for successful fingerprinting, but importantly, provided that sample of the same type and ages are compared. The same samples for the three trees will also be used for isotopic analysis studies to better understand the influence of age and sampling height on the representativeness of fir tree samples.

Based on elemental fingerprinting alone, a successful discrimination between local (Austrian) and foreign (Danish, Irish) Christmas trees was possible.