## P-011: Is death the beginning of a long life? Tracking extractives on their way to heartwood

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Trees use nutrients derived from photosynthesizing cells and translocate or store these materials in special cells, called parenchyma cells (rays). After use of the required substances, trees, unlike animals, have to use space within their tissue to get rid of secondary metabolites. At this point, life ends and heartwood formation takes places, by the death of these cells in the innermost sapwood (transition zone). Furthermore, coordinated transportation by vesicles and falling dry of the innermost xylem is supposed to be a key step in heartwood formation [1].

However, little is known about the synthesis, transport and impregnation of extractives during heartwood formation in context with the micro structure. Therefore, new insights into the biochemical processes are needed by in-situ high resolution methods. To fulfil this purpose, we used Confocal Raman Microscopy (CRM), co-located ESEM and micro CT to unravel the heartwood formation on the micro-level in pine (*Pinus sylvestris*). Marker bands of stilbenes, starch and lipids enabled us to follow this process throughout the transition zone. A rapid chemical change within several annual rings shows the accumulation of heartwood extractives, especially in form of vesicles (Figure 1). Furthermore accumulation exactly in the pits was observed – thus a sealing and cutting off mechanism from the water transporting sapwood tracheids. The high Raman intensity of the pinosylvins enables probing of the extractives within the cell wall and cell corners in the heartwood.

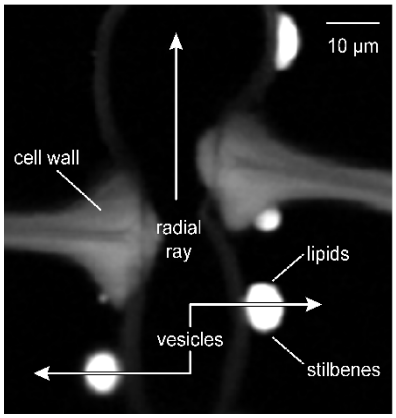


Figure: Transverse Raman image of a radial ray in the transition zone of pine. The CH band integration (2780-3110 1/cm) shows the vesicles attached to the cell wall and pit membrane.

Although, we are not yet close to unravelling the whole heartwood formation process, recent results have disclosed the first steps: vesicles are the beginning!

**References**

[1] STEWART, C. M., 1966: Excretion and Heartwood Formation in Living Trees. Science, **153**, 1068-1074. doi: 10.1126/science.153.3740.1068.

[2] FELHOFER, M., et.al., 2018: Antifungal stilbene impregnation: transport and distribution on the micron-level. Tree Physiology, **38**, Pages 1526–1537; doi.org/10.1093/treephys/tpy073.

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