TALKING TIMBER

MYSTERIES NEW AND OLD

*The BioComposites Centre's **Dr Morwenna Spear** gets to the heart of the matter regarding juvenile and mature fibres*

I read an interesting piece of research this week that showed the equilibrium moisture content (EMC) of juvenile wood is almost 1% lower than the EMC of mature wood. While this will have little practical significance to those trading in timber or even to many wood users, it prompted me to wonder how many people understand what juvenile wood is?

The trend to reliance on plantation grown timber means that we are surrounded by examples of juvenile wood, whether we are choosing some C16 whitewood for DIY projects or specifying large volumes of timber for high end applications. Some awareness of it, and its reasons in the tree is probably beneficial; definitely fascinating!

When the tree is growing, the earliest growth rings it lays down have less need for stiffness and strength and a greater need for flexibility – to withstand the buffeting of the wind, or to flex under the weight of birds or squirrels, or even snow. Stiffness and strength become needed later – when the weight of the crown increases and the trunk, now a more substantial size, must bear the weight of many branches and leaves. The tree's solution for this is elegant. The first 10-15 growth rings outward from the pith are typically wide, and the cell walls have a lightweight design suited to a balance between flexibility and strength. The microfibril angle (angle of winding relative to the cell axis) is relatively high, in the region of 10° (compared to 4-6° in mature wood).

Later in the tree's growth the transition to more robust design at a cellular level (thicker walls, lower microfibril angle) happens gradually, starting at the base of the stem, and progressing only slowly upwards. This means that the part nearest the ground can be producing mature wood, while the same growth ring, near the top of the stem is still producing juvenile wood! But remember, the tree stem tapers – the part near the top probably has between one and 15 growth rings – reflecting the last few years of height increment. What a clever coincidence.

The upshot of this is that when a tree is felled and the log converted, the first rings closest to the pith – regardless of height in the tree – will be juvenile, and the rings further out towards the bark will be mature, with narrower growth rings and more prominent differences between early and late wood. Mature wood is typically stiffer and stronger than juvenile wood, and in many cases has better dimensional stability. Both of these benefits relate to the biomechanics at the cell level, and can be useful when seeking the right wood for the job.

So far, so good, but one or more of you are probably wondering about heartwood – doesn't this come from the part nearest the centre of the log too? The answer is yes, but I need to remind you that heartwood is very different from juvenile wood.

In trees that are felled young (before heartwood formation starts) it is possible to see juvenile wood but have no heartwood present. The whole of the trunk in such a young tree is still acting as sapwood – conducting sap upwards in the trunk. Conversely, in a very old tree, perhaps 80-100 years of age, it would be possible to find regions of heartwood that are mature wood, as well as the most central part which is both heartwood and juvenile. The heartwood, of course, is the portion of the stem which has been 'sealed off' by deposition of extractives to protect it, once sap flow ceases in this region – to be taken on by newer growth rings closer to the bark.

Now as for my opening statement about equilibrium moisture content – maybe the reasons for this difference in juvenile wood and mature wood can be explained another time. I hope the scientists concerned are still looking for the explanation for us... ■

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Below: Juvenile wood (near the pith) but also some mature wood; both are in the heartwood of the piece