A Key for Identifying Stumps of B.C. Tree Species Based on Macroscopic Features of Wood

Introduction

Identifying stumps with certainty after logging is not easy, because more often than not, the diagnostic features are obliterated by logging damage. Even on a freshly cut stump, one has only the ring pattern and a bit of bark to go by. If there are remnants of bark visible, with a bit of practice at least half a dozen species can be identified with certainty. However, the most reliable method of positive identification should be based on the wood.

The macroscopic method of wood identification utilizes wood features exposed on the end-grain, in cross section, under slight magnification. This method has the advantage of utilizing simple, inexpensive tools, like a sharp knife and a 15-power (15X) and lens (loupe).

Wood identification is alot like identifying different makes of cars on the shopping mall parking lot. Although modern cars have taken on the identity of a beluga whale, it is still possible to tell them apart with certainty, just by looking a the insignia on the hood ornaments. The same can be said of B.C. softwoods, in that they all look alike. But, all woods have their own particular "hood ornaments", which make positive identification possible. Instead of the "Ford Oval", a spruce wood will be creamy-white in colour, it will have small resin canals present, visible only under magnification, and its latewood bands are narrow, with a gradual transition from earlywood to latewood.

Methods

Obtaining the Wood Sample

For obtaining the wood sample, one does not need to cut a "cookie" from the stump, because a small sample will suffice, about the size of a large eraser. I would recommend a foldable hand-saw and an axe. One should make a horizontal saw cut a few centimeters below the top surface, and split the wood sample off with an axe.

The stump sub-samples should be numbered in such a way that they can withstand hot-water soaking. The use of an indelible pencil that is truly indelible, even after a 24-hour cycle of boiling in hot water, then in alcohol for extraction (*Dixon Eterno Indelible - copying*), and the numbers are still legible. As an alternative, wood samples could be kept in individually numbered zip-lock bags, which could take water for soaking the wood, thus facilitating hand-sectioning.

Sample Preparation

How to produce a cleanly cut surface on the end grain of your sample?

One of the most common "mistakes" in wood identification work is *the lack of a cleanly cut cross-sectional surface*. Torn grain, knife-marks, and the presence of small bits of wood that is produced during sectioning can obscure vital diagnostic features.

There are 5 pre-requisites to producing a good cleanly-cut cross-sectional surface: 1) a sharp knife; 2) a sharp knife; 3) a sharp knife; 4) a sharp knife; 5) a sharp knife. It would be helpful for novice woodworkers to make practice cuts, to get the feel for the angle of attack, the difference between a sliding and a non-sliding knife-blade movement (sliding works better). The proper technique is difficult to describe, one just has to experience it through trial and error. Figure 5 could be used as guide, although there is a close proximity between the cutting edge and the hand.

As an experienced woodcarver, I can't emphasize enough the safety aspect of sample preparation, because of the ever-present danger of nasty cuts.

The first thing that must be done for facilitating hand sectioning, is that the wood samples have to be soaked in hot water, because wet wood is two to three times easier to cut than dry wood. By the time the water cools, say 15-30 minutes, sectioning can begin. Before grabbing the wood for sectioning, examine the two end-grains, and select the one less damaged (more often than not, one end is frayed, with numerous gouges). Hold the wood in your left-hand and the knife in your right-hand. Of course, if one is left-handed, "hand roles" are reversed.

The cutting edge of the knife blade should be aligned at a right angle to the annual rings. This alignment will help in making smooth cuts, because the cutting edge of the blade engages both earlywood and latewood bands at the same time. Conversely, if the cutting edge is engaged parallel to the ring boundaries, the cutting action will be uneven, because the earlywood puts up little resistance, while the latewood can feel like "a brick wall" because of its higher density. As an added bonus, by cutting through several annual rings, it improves the chances of viewing resin canals in spruce, because this feature (i.e., resin canals) can be erratic in distribution.

Choice of Knives

There are a number of different knives that could be used for producing a satisfactory cross-sectional surface. I got the best results with a custom-made knife that I use in woodcarving. The main advantage of this knife is the excellent quality steel blade, which can be sharpened and honed to a keen edge, and it keeps its edge for a long time; disadvantage is the $40.00 price tag.

A very satisfactory alternative is a "box-cutter" (price from $1.00 to $2.50), which comes with replaceable blades ($6.00 for 10 blades). Of course, with this knife one does not have to worry about sharpening, because the "spent blade" can be snapped off, and a new segment can be put into service.

Sharpening Stones and Stropping Tools

The best sharpening stone on the market is the snow-white pure aluminum-oxide sharpening stone, made with the second hardest substance known to man. This man-made ceramic stone can be used dry, or with water. I prefer a few drops of water, because the water floats the steel particles.

Sharpening-motion is not unlike sharpening a pencil to a sharp point on paper; about a dozen circular motions, while holding the wooden pencil under an acute angle. For the carving knife, the blade should be at about a 10 degree angle. This can be approximated by placing a dime

under the back-edge of the blade. One should use light to moderate pressure, while doing about a dozen circular loops on both sides. Finish off with a couple of alterating sweeps.

A leather strop is highly recommended for providing a razor-blade-like finish. The Lee Valley "green honing compound" has the right "bite".

The honing angle and action is quite different from the stone sharpening. Here the knife blade is held flat, in direct contact with the leather. The back of the knife should not be raised at all, or only slightly, to prevent the blade from digging into the leather. The blade should be pulled in a straight line, with the cutting-edge at a right angle to the direction of pull. One should alternate, so there is burring on the cutting edge. In as little as a dozen strokes, the knife blade will develop a mirror-like finish.

Magnifying Glasses, Hand-Lenses, Loupes

This wood identification manual was developed by using a "*15-Power Lighted Loupe*" from Lee Valley Tools (Cat. # 99K10.41...$30.00). The advantage of a built-in light source should not be overlooked, because it can be used under industrial settings with low light levels.

A 10X magnifying lens with excellent optical properties was used. This "excellence" was noted when this loupe was compared to "ordinary" (and less expensive) hand-lenses, because the image was crisper and the in-focus field of view was wider than with the "ordinary" ones.

This information is given because it is very difficult to secure good quality tools, which are needed for making wood identification possible using the macroscopic method.

How to Hold the Loupe and the Wood Sample to be Identified?

With the Lee Valley model, one can place the magnifying lens right on the wood sample, because the transparent plastic housing below the lens is at the exact focal length, therefore, the image will be in focus "automatically". I found that a small wooden wedge is handy to elevate the handle part, because it tends to drop a few millimeters if not held in place, putting the image out of focus.

Wood Identification

The process of wood identification works through a dichotomous key. In other words, at each stage of the process, a question is posed, and one has a chance to pick one answer from two given (see Appendix 3).

For example, concentrating just on the S-P-F group. it works as follows:

Looking at the smooth cross section of a stump sample, are resin canals present and visible, or are they absent? If resin canals are absent, the wood is **balsam**. If resin canals are present, but relatively sparse, and they are hard to see, even under magnification, and transition from earlywood to latewood is gradual, then it is a **spruce**. If the resin canals are frequent, large and easy to see, and the latewood band is prominent, with abrupt transition beween earlywood and latewood, and the wood has a dimpled texture on tangentially-split surface, then it is **lodgepole pine**. With this paragraph we have "solved" the Central and Northern B.C. Interior S-P-F species group identification.

Because of the well recognized Biogeoclimatic zones in BC, one can use the dichotomous key by "concentrating" on the following regions and their species groups:

1) Central and Northern BC interior, the land of spruce-pine-fir (S-P-F).
2) Coast and Vancouver Island, where the species group will consist of Douglas-fir, western hemlock, amabilis fir, grand fir, western redcedar, white pine, and yellow cedar.
3) The Kootenays and Interior wet belt, where one could find Doulas-fir, Ponderosa pine, western larch, lodgepole pine, Engelmann and white spruce, western redcedar, western hemlock, white pine, grand fir, and subalpine fir.

Appendix 4 contains key illustrations for 11 different BC softwood species. The microphotographs were taken with a hand-held digital camera, right through the 15-times-magnification lighted loupe. Diagnostic features were noted, and they are discussed in the Figure captions.

Appendix 5 shows the discouraging appearance of stumps after recent logging. Most of the stumps were photographed in the Kootenays. Harvesting cuts were made by harvesters and chainsaws. An interesting artifact was noted, particularly when the harvester cutting head got dull, because it tended to chew up the heartwood, giving the appearance of badly decayed wood. Because the sapwood looked normal, this must have been the result of moisture content differences between the Heart and Sap, 45% and 140% moisture content, respectively. The freshly cut surfaces were created with a chainsaw, and the cutting did not "chew up" the heartwood.

The key to success in this enterprise is practice. For example, what are the differences between a "large" and a "small" resin canal? Or for that matter, "what is a resin canal and what does it look like"? What about "gradual" and "abrupt" transition from earlywood to latewood? But the reader should not fret, because "all the secrets have been spelled out". Just remember, practice makes perfect. Use the reference samples and photographs provided, before attempting to identify the first unknown wood sample on your own.

Appendix 3. Dichotomous Key for Identifying Stumps of B.C. Softwoods Based on Macroscopic Features of Wood

Note; all features are to be seen at 15-times magnification on smoothly cut clean cross-sectional surfaces.

Step		Go To Step
1	a) Resin canals present	2
	b) Resin canals normally absent	6
2	a) Latewood prominent, easy to see	3
	b) Latewood is not prominent, wood has a light colour	5
3	a) Resin canals are large, easy to see, relatively frequent	4
	b) Resin canals are very small, hard to see even with loupe, and they are relatively infrequent	Douglas-fir Western larch
4	a) EW-LW transition gradual, wood is easy to cut	Ponderosa pine
	b) EW-LW transition abrupt, wood is dimpled on the flat grain (tangential surface)	Lodgepole pine
5	a) Resin canals are large and they are the easiest to see as distinct pinprick cavities	White pine
	b) Resin canals (RC) are very small, and they are hard to see even with the loupe, RC occuring in multiples of 2-3 tangentially in the latewood, often no more than “white dots“	Spruces
6	a) Latewood brown and prominent	7
	b) Latewood pale and narrow, wood smells like raw potato	Yellow cedar
7	a) Latewood about 1/3 or more of the ring width	Western hemlock Grand fir Amabilis fir Subalpine fir
	b) Latewood is 1/4 or less of ring width on average, wood smells very fragrant (like cedar)	Western redcedar

Appendix 4. List of Figures

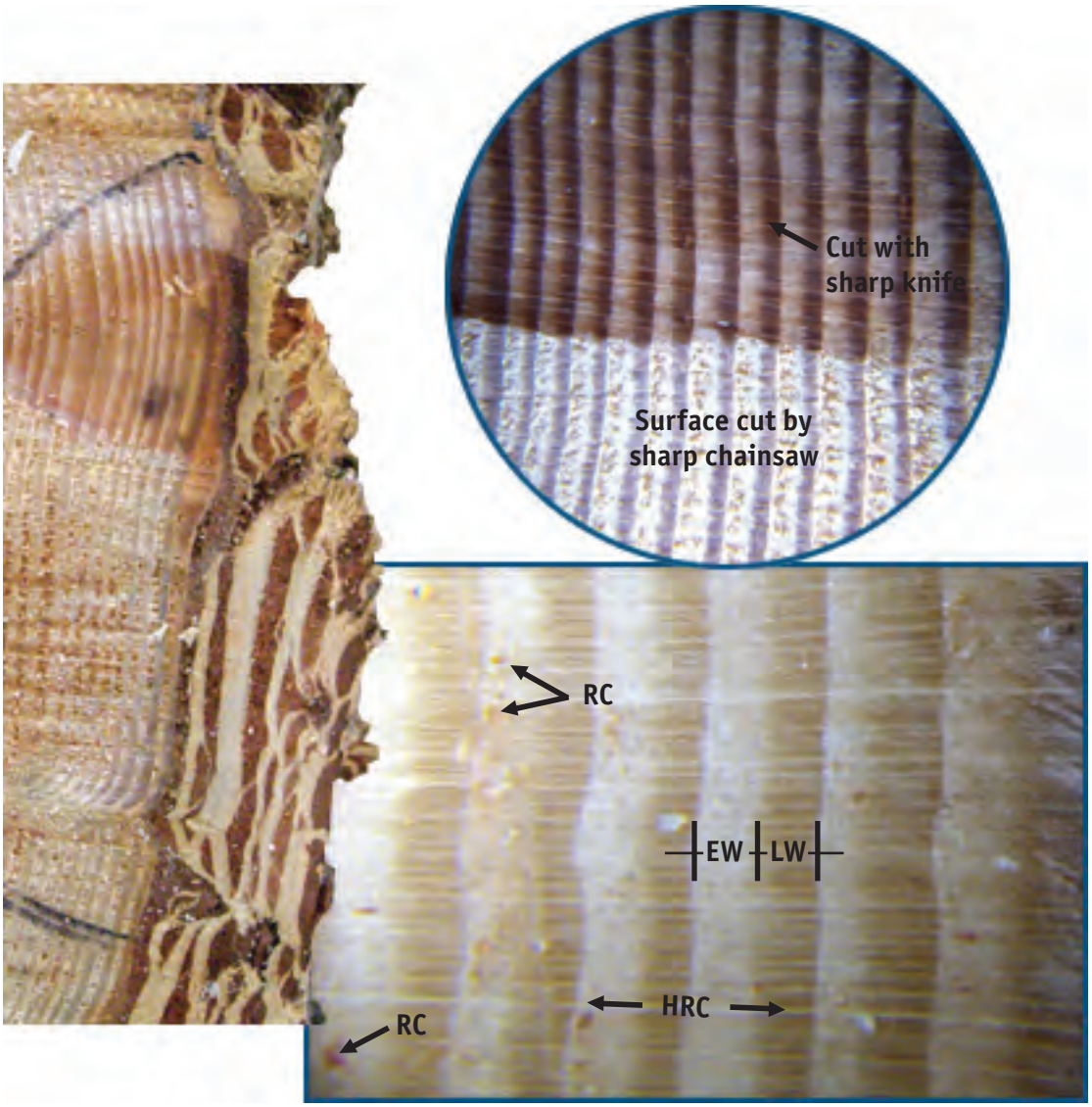


Figure 11. Douglas-fir (Pseudotsuga menziesii). Note prominent latewood (LW) and abrupt transition from earlywood (EW) to LW. Resin canals (RC) are small, scattered throughout the rings. Horizontal resin canals (HRC) appear as white lines at irregular intervals. The wood is hard to cut because of high-density LW. Note the difference between the surface cut by a sharp chainsaw, and the smoothly cut surface with a sharp knife, which reveals the diagnostic features.

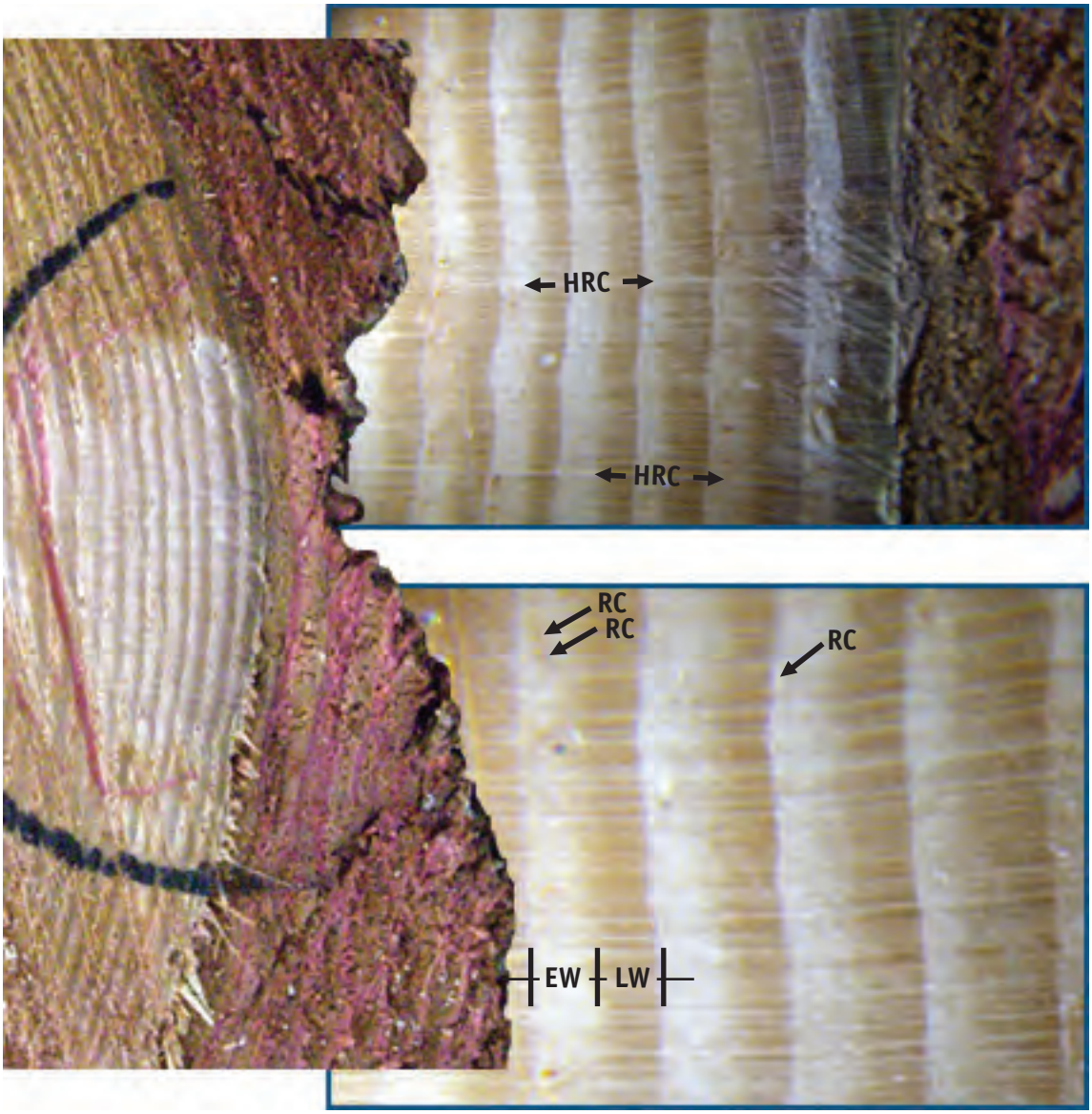


Figure 12. Western larch (Larix occidentalis). Carbon-copy of Douglas-fir, and without the beet-coloured bark it is not possible to distinguish these two species macroscopically.

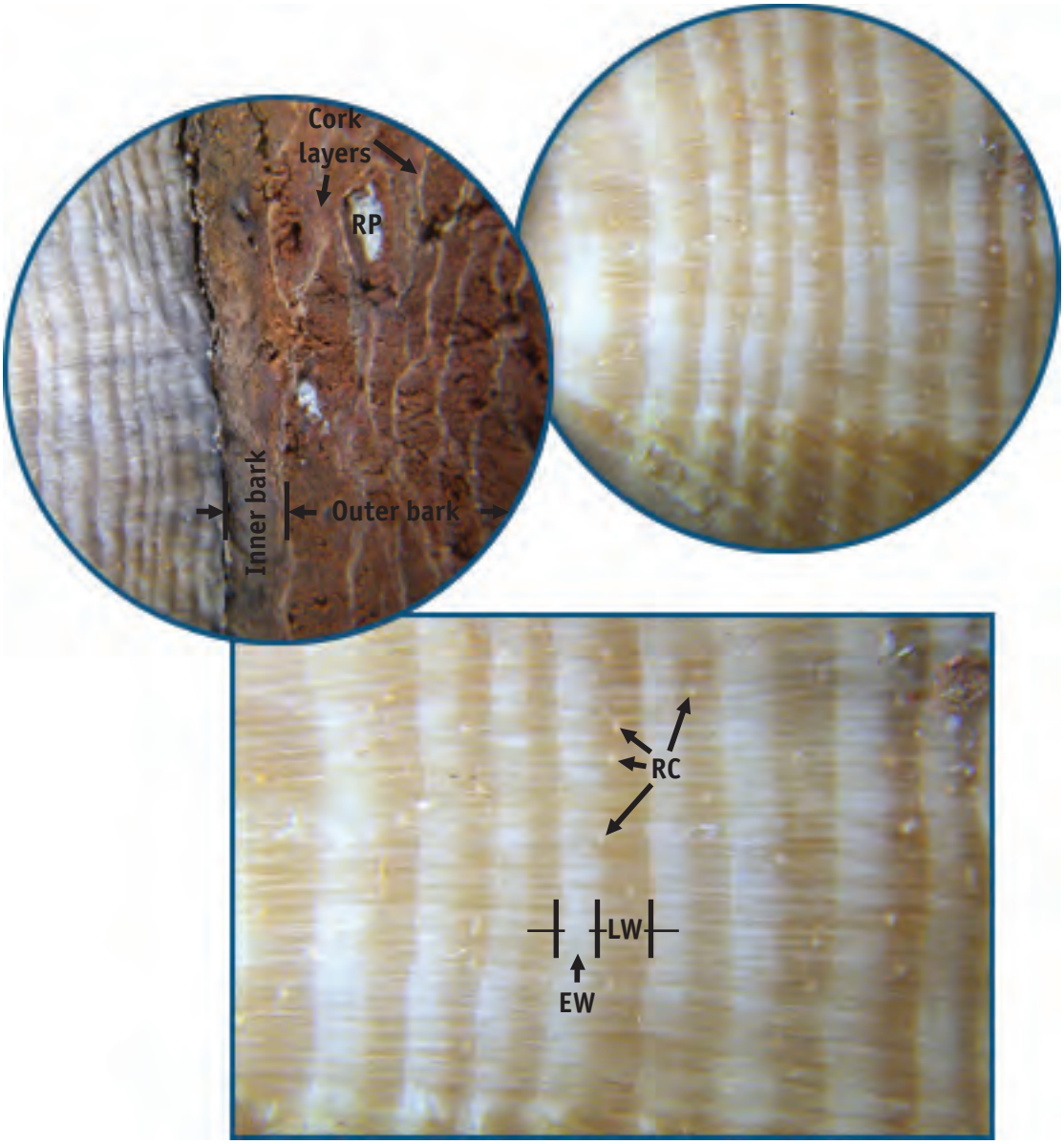


Figure 13. Lodgepole pine (Pinus contorta). Note prominent latewood (LW), and abrupt transition from earlywood (EW) to LW (not unlike Douglas-fir, but there is an increased frequency of resin canals (RC), they are larger and easier to see). The wood is also different; LW has lower density, therefore, the wood cuts easily with a sharp knife. Annual rings tend to be narrow, because of smaller tree sizes. Note poorly developed narrow cork tissue layers in the outer bark, and some resin pockets (RP)

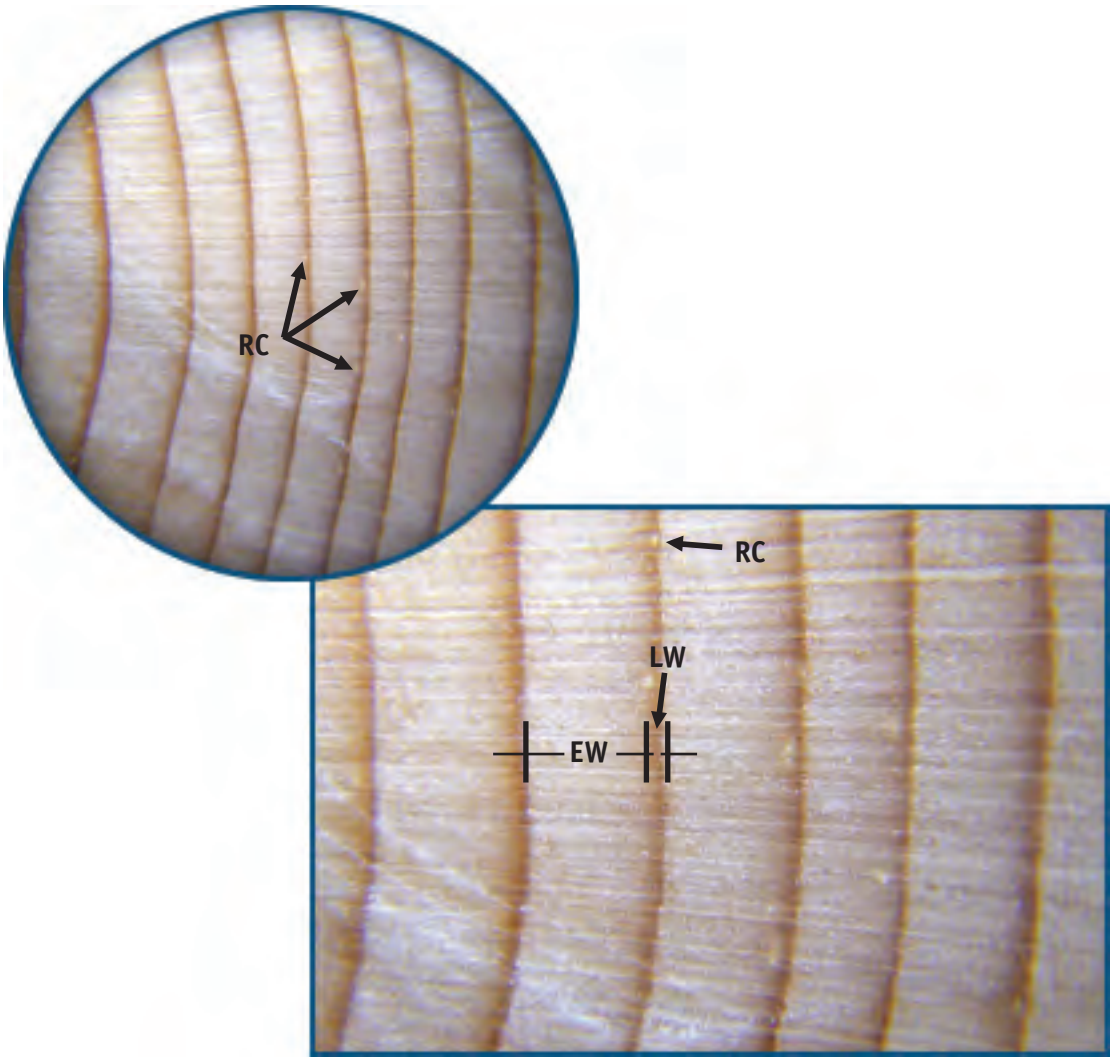


Figure 14. Engelmann spruce (Picea engelmannii). The wood of the spruce is moderately soft, easy to cut, and it has a creamy-light colour, but it is not possible to separate them macroscopically. The transition from early wood (EW) to narrow latewood (LW) is gradual. Resin canals (RC) congregate in the LW mostly, and they are small, hard to see even under magnification.

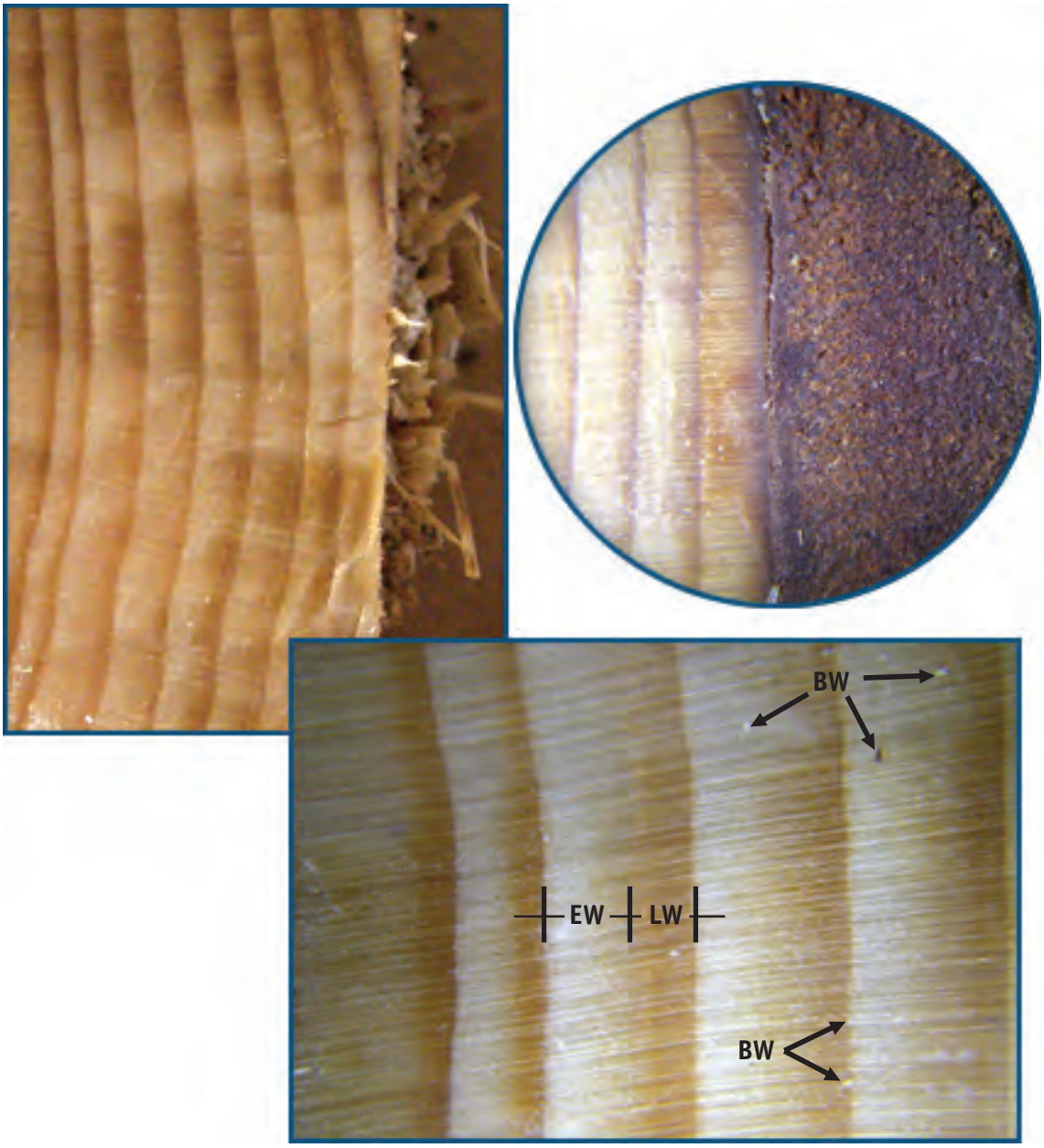


Figure 15. Amabilis fir (Abies amabilis). Normally, this species does not have any resin canals. The transition from earlywood (EW) to latewood (LW) is gradual. Smoothly, and cleanly cut cross-sectional surfaces are a must with this species, because bits of wood (BW) can look like resin canals to a novice.

Figure 16. Subalpine fir (Abies lasiocarpa). The "true firs" (Abies genus) are impossible to separate even microscopically, but the Biogeoclimatic zones should give us a good idea which one we are dealing with. Normally, this species does not have any resin canals. The transition from earlywood to latewood is gradual. Smoothly, and cleanly cut cross-sectional surfaces are a must with this species, because bits of wood can look like resin canals to a novice. Don't forget to smell this wood; it has an unpleasant dirty-socks smell in the heartwood.

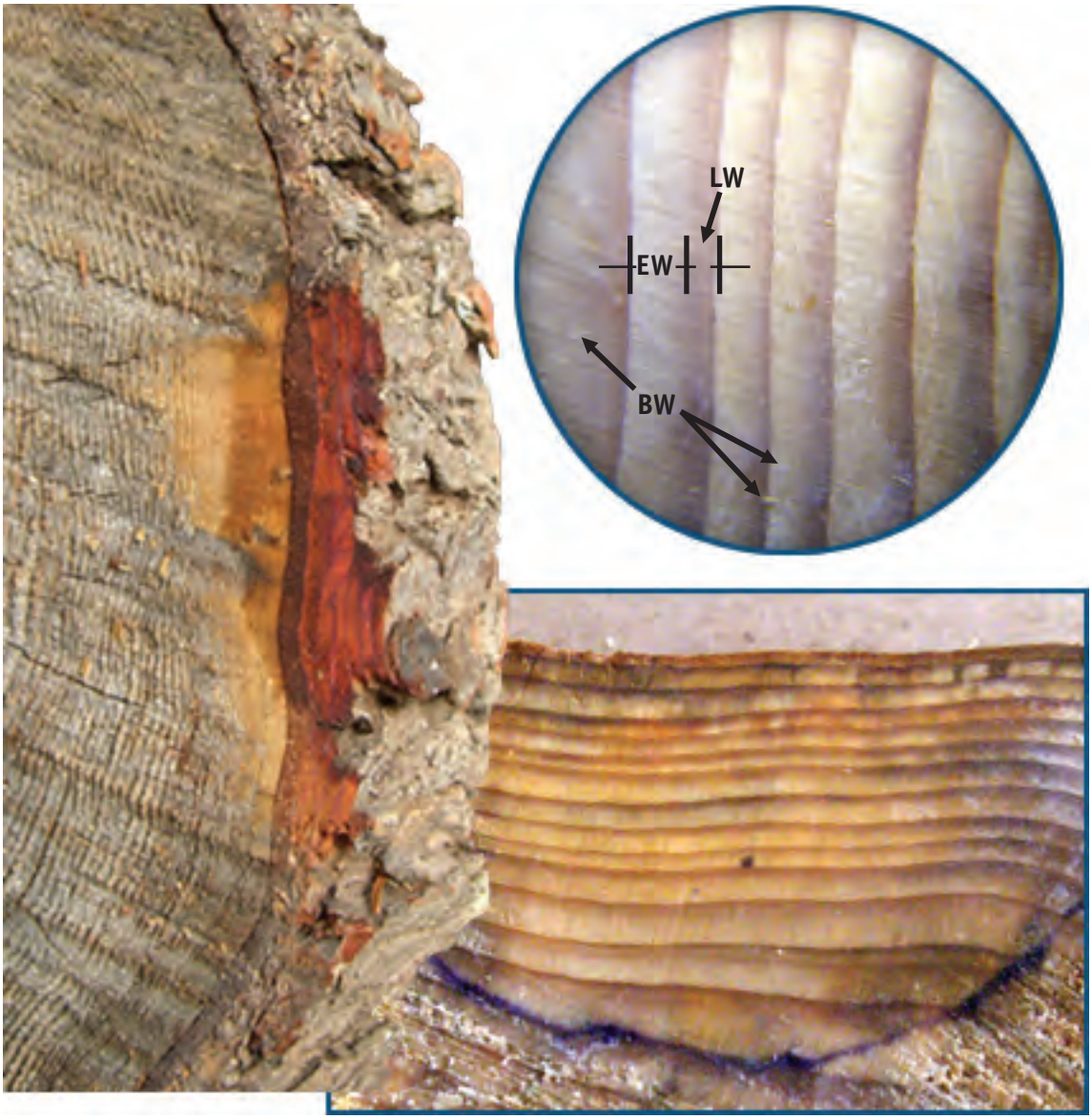


Figure 17. ***Western hemlock (Tsuga heterophylla). Normally, this species does not have any resin canals. The transition from earlywood (EW) to latewood (LW) is gradual. Smoothly, and cleanly cut cross-sectional surfaces are a must with this species, because bits of wood (BW) can look like resin canals to a novice. Positive wood identification is possible only if bits of bark are present, through the beet-coloured cork tissue layers (C).***

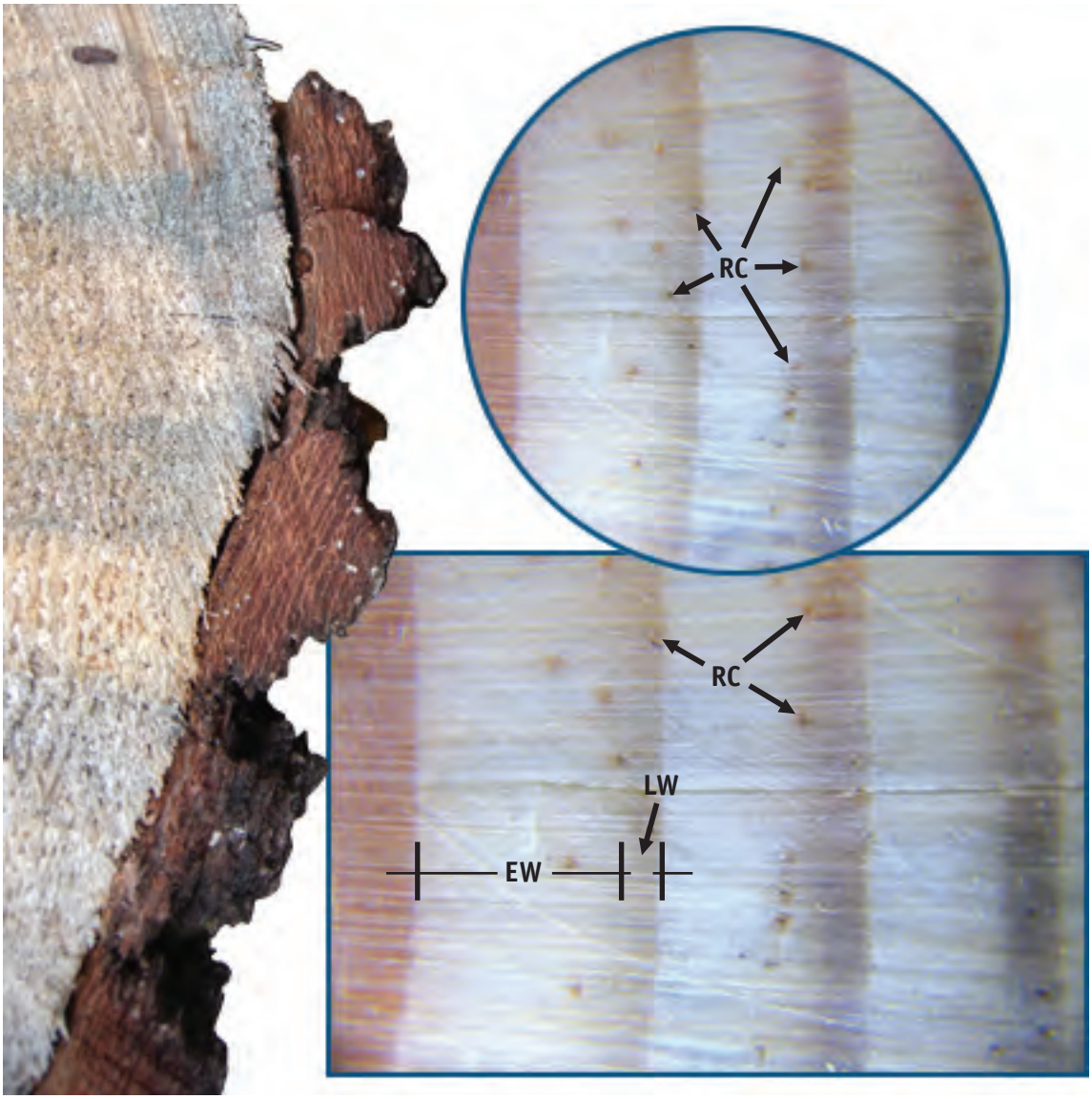


Figure 18. White pine (Pinus monticola). The wood of white pine is soft and easy to cut, because of its low-density latewood. The transition from earlywood (EW) to latewood (LW) is gradual. Resin canals (RC) are the largest of B.C. softwoods, therefore, very easy to see. Resin canals are frequently open, because of their thin-walled epithelial cell linings. Cork tissue layers in outer bark are thin but easy to see.

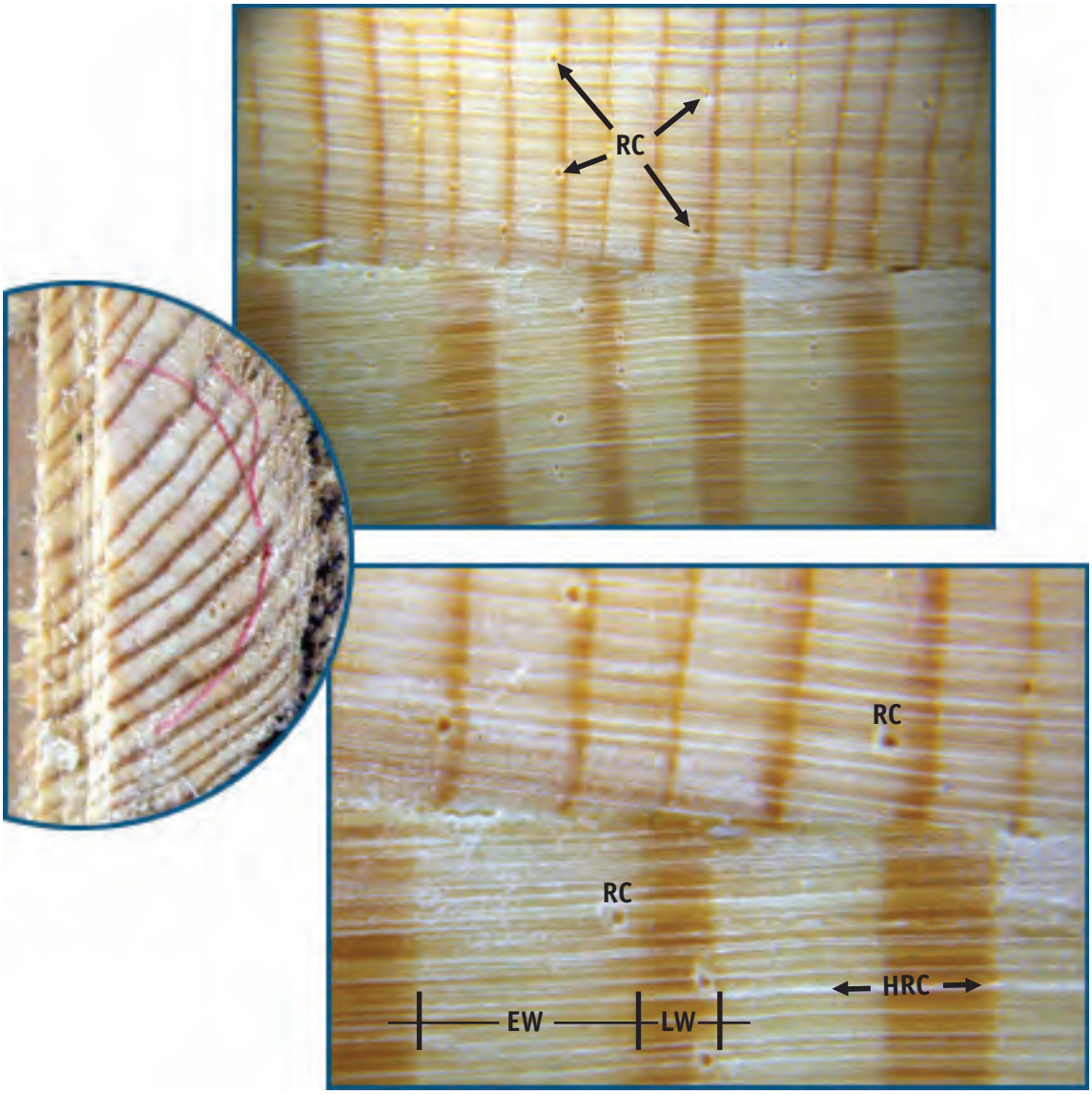


Figure 19. ***Ponderosa pine (Pinus ponderosa). The wood of ponderosa pine is very similar to white pine, except it has more prominent latewood (LW) bands. The wood is easy to cut, and has a "greasy" feel to it. Transition from earlywood (EW) to latewood (LW) can be abrupt or gradual. Resin canals (RC) are among the largest of B.C. softwoods, therefore, very easy to see. Resin canals are frequently open. Horizontal resin canals (HRC) are easy to see because of their large size.***

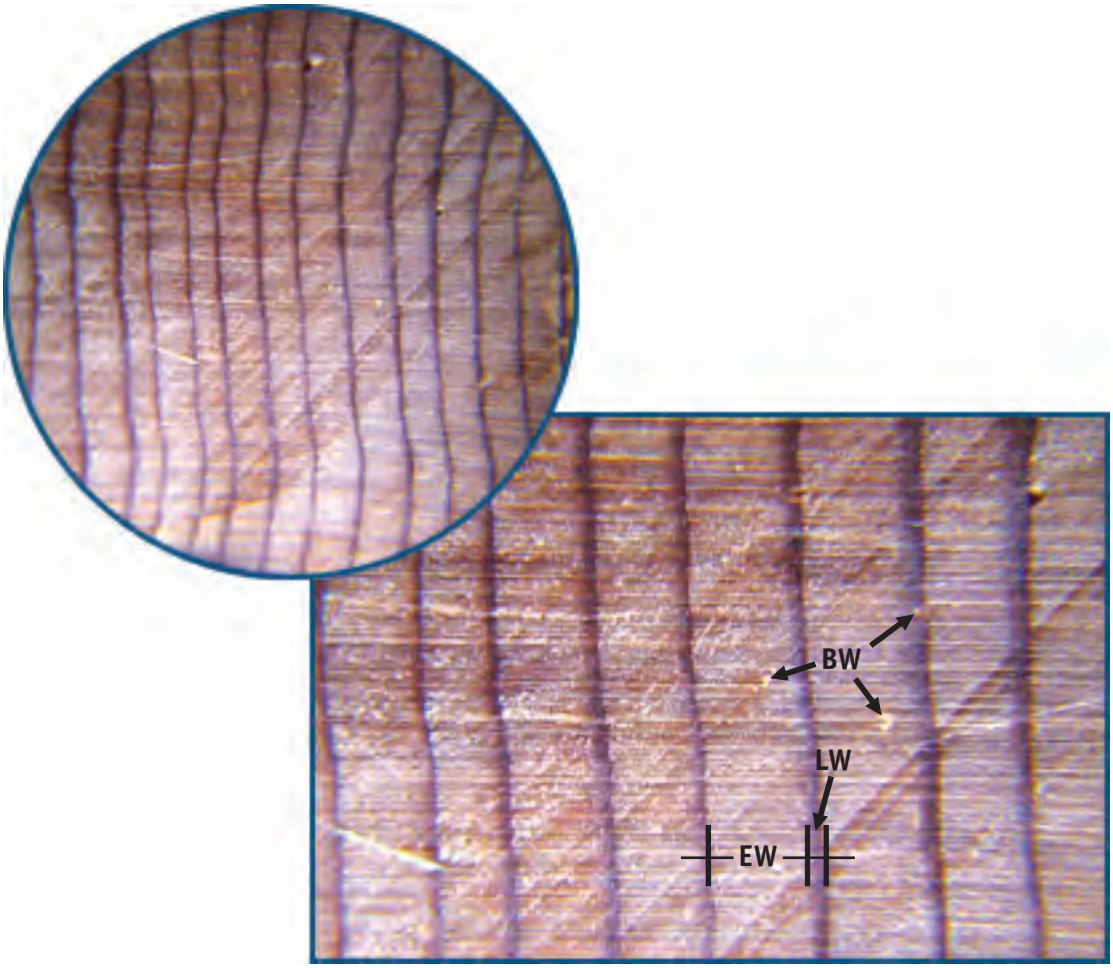


Figure 20. Western redcedar (Thuja plicata). This species does not have any resin canals. The transition from earlywood (EW) to dark and narrow latewood (LW) is gradual. Smoothly- and cleanly-cut cross-sectional surfaces are a must with this species, because bits of wood (BW) can look like resin canals to a novice. On average, latewood is 1.4 or less of total ring width. A sharp knife is a must to cross-cut this wood with satisfactory results (note diagonal knife-marks in the pictures). Don't forget to check the smell of the wood, to pick up cedar aroma.

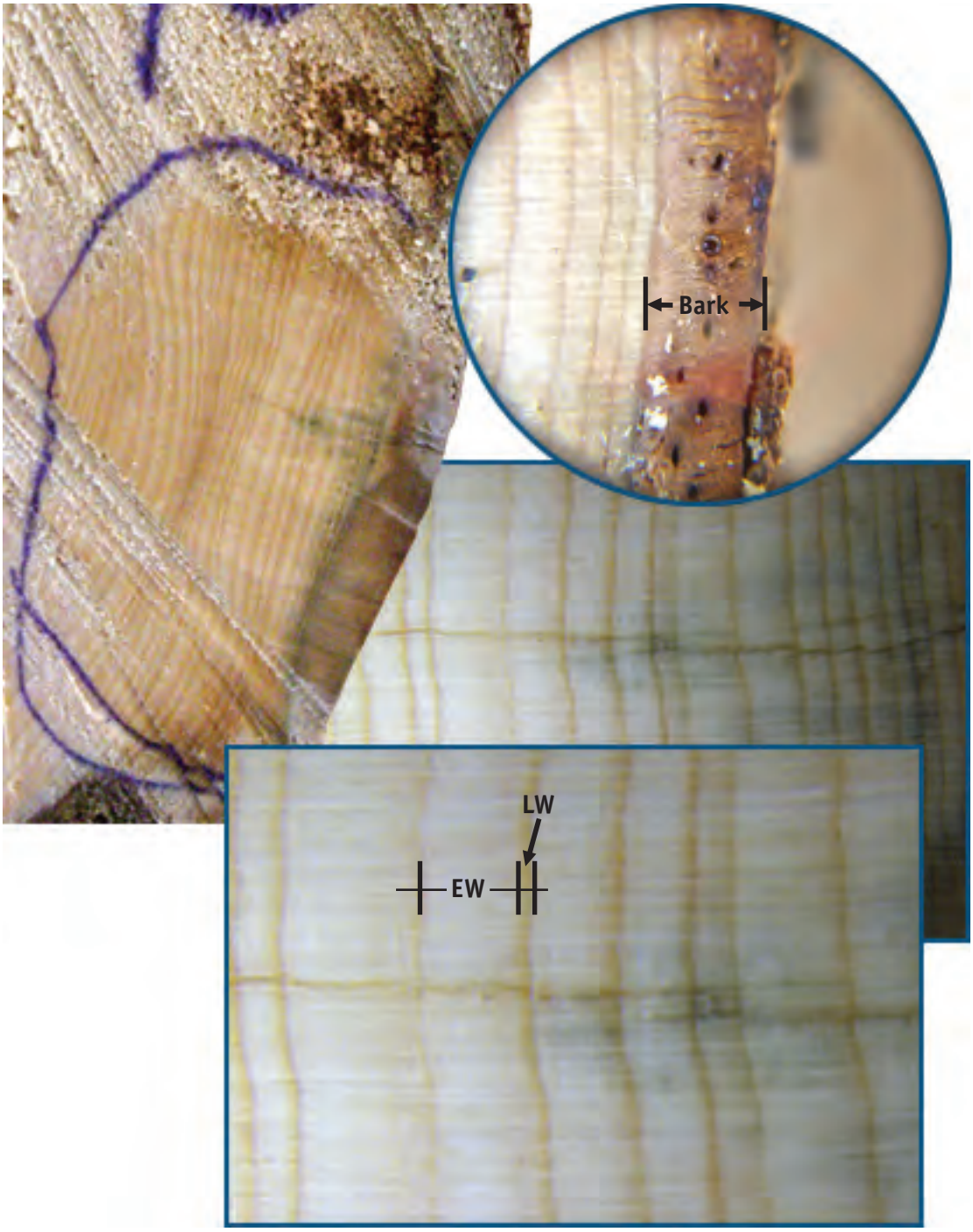
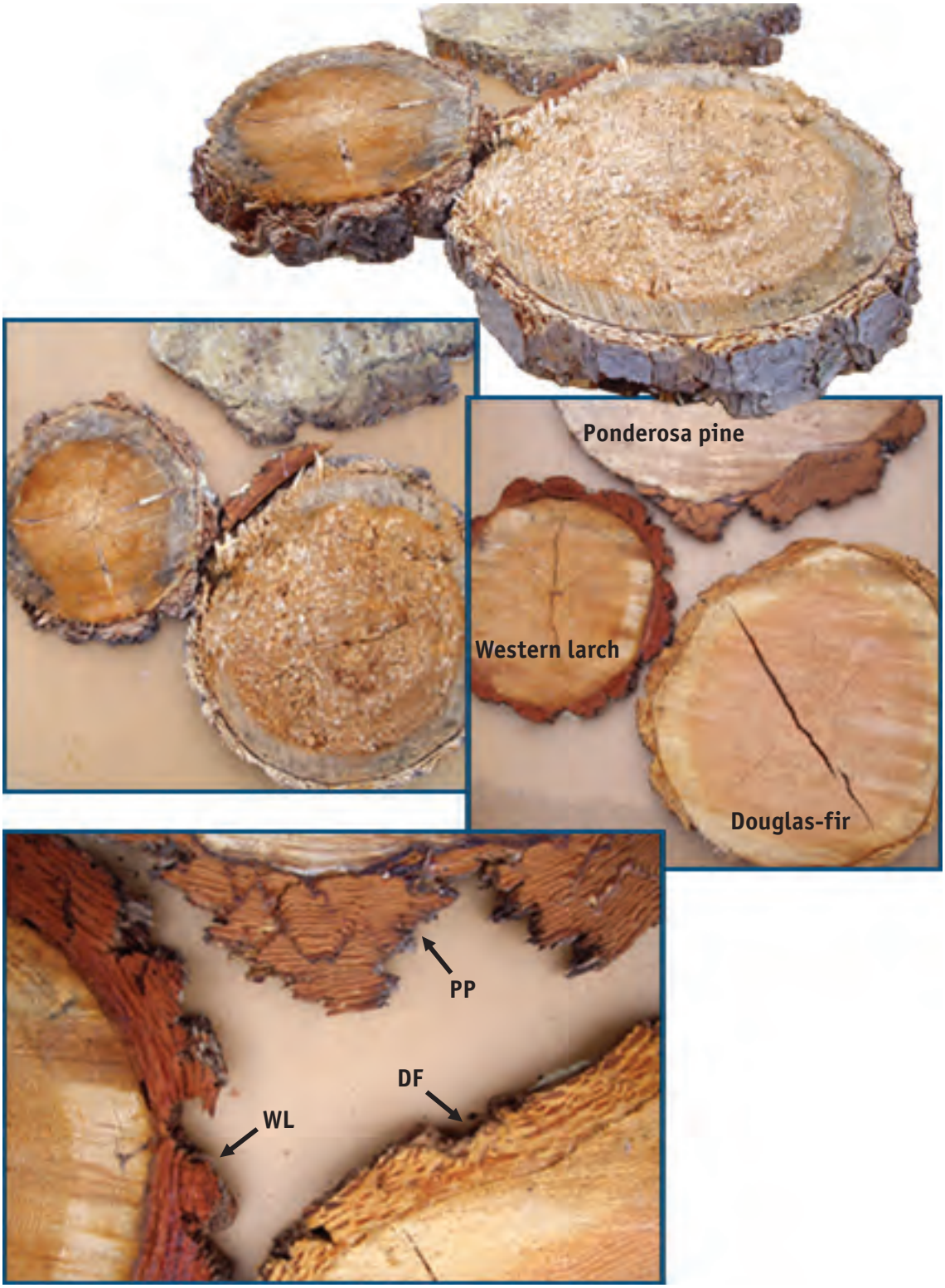
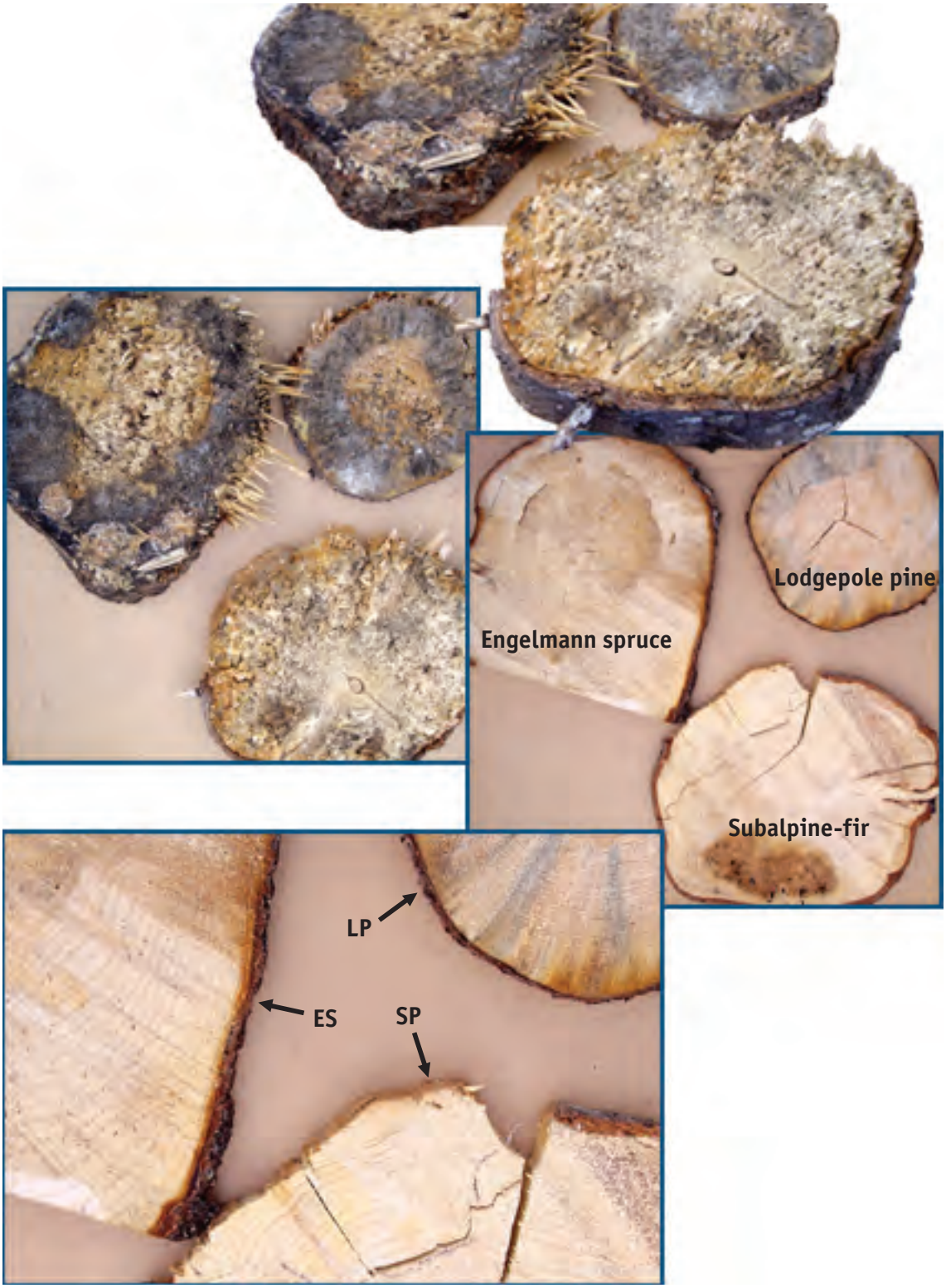


Figure 21. Yellow cedar (Chamaecyparis nootkatensis). This species does not have any resin canals, although resin ducts are present in its inner living bark. The transition from earlywood (EW) to light and narrow latewood (LW) is very gradual. This wood is easy to cut because of its low-density latewood. On average, latewood is much less than 1/4 of total ring width. Don't forget to check the smell of the wood, to pick up its pungent raw-potato aroma.

Appendix 5. Stumps Showing Original Weathered Surfaces after Harvesting and Fresh Cut Cross-Sectional Surfaces




Lodgepole pine
Engelmann spruce
Subalpine-fir
LP
ES
SP