Dating historic cabins and archeological sites with tree-rings

by Ed Berg

We've had lots of fun moving the old Andrew Berg homestead cabin up to the Refuge Headquarters. Our Youth Conservation Corps teenagers brought the logs up from Tustumena Lake last summer, and Refuge Historian Gary Titus mobilized many community volunteers for the cabin raising party in September. The new spruce shake roof is on, and the cabin is closed in for the winter.

Readers of this column may recall my articles about using tree-rings to date old wood. There are many old cabins on the Refuge; some are no more than a relict corner of logs protected by an overhanging spruce, others still have upright walls, and some are still in use today. Many of these structures can be dated with tree-rings because they were made with locally-grown trees.

Gary Titus wasn't quite convinced that such dating was possible, so I said we should put the idea to a test. We know from Andrew Berg's diary that he started putting up the logs for his cabin on April 21, 1935. If we were to date a log from this cabin, it shouldn't date any later than 1935.

To start the dating process, Gary sawed off a disc from a discarded log and sanded it well with a belt sander using 400-grit paper. I then took a sharp needle and scored five radii on the sanded face. The next step was to measure the width of the tree-rings year by year along each radius. This would give us five independent sets of ring-width measurements. We measured the ring-widths in our lab with a remarkable device called a "sliding bench micrometer," which is connected to a 60x microscope and a computer. With this machine we can easily measure ring-widths to 0.01 millimeter. We recorded each measurement on the computer by pressing a button. It took about 20 minutes to measure the 88 rings (years) of a single radius.

Next came the magic, called "cross-dating." With cross-dating, the measured (but undated) ring-widths of the sample are statistically compared with a reference series of dated ring-widths called a "chronology." Once the sample is properly lined up with the chronology, the age of each ring of the sample becomes known. The year of the outermost ring is the "death date" of the sample.

We used a chronology averaged from 91 trees in the Tustumena Lake area. Over the last several years Andy DeVolder and I have developed this chronology, starting with 48 live white spruce (with known outer ring dates), and subsequently adding many dead trees from the 19th century. The dead trees were cross-dated against the live trees, and then added to the chronology to extend it back in time. The chronology now covers the period 1601 to 1996.

In order to effectively cross-date dead wood, there must be some year-to-year variation in ring-widths, because cross-dating is based on the idea of matching up relative ring-widths between the unknown sample and the known chronology. The "fat" rings of the sample are matched with the fat rings of the chronology, and the "thin" rings are matched with the thin rings. If all the rings are the same width, this can't be done; one match is as good as another, and hence useless.

The disc from the Andrew Berg cabin was not especially promising; many of the rings were about the same size. This condition is described as "complacent" and it indicates a benign site with favorable growing conditions. For effective cross-dating we like a "stressed" tree, where the tree is sensitive to differences in growing season temperatures or precipitation, and there is much variation in ring-width from year to year. Furthermore, this tree was rather young, with only 88 rings.

Nevertheless, all five radii from the sample dated quite convincingly to 1934, with correlations ranging from c = 0.37 to 0.71 and a mean of c = 0.49, between the individual radii and the white spruce chronology. (A correlation of c = 1.00 is the highest possible score—a perfect correlation.) This is a remarkably good result, especially given a complacent sample, with only a moderate number of rings.

To further test the robustness of the methodology we cross-dated the five radii with a black spruce chronology, using 15 trees from the Windy Point burn area, covering the period 1769 to 1993. The log from

the Andrew Berg cabin is most likely white spruce, given its large diameter (8") for an 88-year-old tree. The black spruce chronology correlated rather poorly with the white spruce chronology (at c = 0.33), indicating that white and black spruce respond somewhat differently to climate in this area. This is not unusual, and normally we try to avoid mixing species when cross-dating. Nevertheless, four of the five radii cross-dated to 1934, which is surprisingly good. The fifth radius dated to 1910, which is clearly a spurious correlation.

Cross-dating shows the death date of the tree, not when the building was constructed. A cabin could be built several years after the tree was killed, but not before that time. As noted, Andrew Berg's diary tells us that he began building this cabin in 1935. One might expect, however, that he cut many of the trees the year before in order to let them cure over the winter, so 1934 is an entirely acceptable death date for this log.

The dark part of a tree-ring is called the "latewood" and it typically forms in late July and August in this area. The late wood of our sample was just beginning to form and was not complete, indicating that the tree was probably cut in late July of 1934.

We would like to use this method to date older wood, say from archeological sites. Our present chronology could be extended back from 1601 by another 500 or 1000 years by adding more dead (and probably buried) wood. This would cover many of the Dena'ina house pit sites in the Soldotna–Kasilof area.

In western Prince William Sound, grad student David Barclay collected dead trees exposed by recent retreat of various glaciers. Using cross-dating, he developed a chronology back to 873 A.D. That chronology could be used to date archeological wood between Seward and Whittier, but it probably wouldn't work on this side of the mountains because the climate is so different.

Generally, if wood has been kept underwater or below the water table in the ground, it can remain sound for hundreds of years. Foundation excavations, drained lakes and wetlands, gravel pits, river bank erosion faces—any of these could turn up long-buried wood that is still pretty solid with useable rings.

So, let me put out a call to all home builders, excavators, and backhoe operators: if you dig up any solid logs, please give us a call at 260-2812 or 262-7021 so that we can get a sample (e.g., a disk). Your old logs might be the keys to unlocking some exciting archeological history of our Native predecessors.

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