ARTIFACTS AND FEATURES
DENDROCHRONOLOGY

This article is one of an occasional series discussing matters archaeological, especially with reference to the Maturango Museum. In previous articles we have talked about why chronologies are important in archaeology, and about a few qualitative techniques for establishing dates or sequences. Today we move on to another topic, quantitative chronological techniques.

The first quantitative technique to be developed and applied in archaeology was dendrochronology, or tree-ring dating. It was developed in 1928 by A. E. Douglass of the University of Arizona, an astronomer who was studying sun-spot cycles. He theorized that climatic moisture was affected by the 11-year sun-spot cycle, and concluded that the evidence should be observable in tree rings. In the course of the studies he verified that the climatic sequence of wet and dry years does in fact leave a detectable pattern in the tree ring record: in general, wet years lead to wide rings and dry years to narrow rings. The important byproduct of this for archaeology is that the sequence of wet and dry years in a given locality never repeats itself, so the tree rings contain a unique signature which allows correlating between an old log and a new one, as long as there is some overlap.

Douglass, to his credit, realized that his data would be useful to archaeologists, who at that time had no methods for assigning quantitative dates. Qualitative methods such as pottery seriation, stratigraphic excavation, and marker artifacts allow construction of sequences, but not absolute dating. Dendrochronology, for the first time, would allow an archaeologist to assign a date to the event of cutting down a tree to build a structure or use as fuel.

Although the principle is straightforward, there were pitfalls to be resolved. Sometimes overlaps could not be identified – at the time it was first applied, the tree-ring sequence had an annoying gap in it right at a time of major interest in the Southwest. Furthermore, sometimes a very dry year will cause a tree to skip a year in its ring sequence; sometimes double rings are grown, so reading tree rings requires as much skill as deciphering a puzzle. Also, the tree-ring signature is most visible in trees with distinct rings, and which are living in marginal environments. Pine and juniper, living on dry mountain sides, work very well, because they are moisture-stressed and respond readily to rain; a cottonwood living in a river bottom is useless for dating, because it already has all the water it needs.

Because the dating works best on moisture-stressed trees, it has been used most widely and successfully in the higher regions of the Southwest, in the upland regions of the Colorado Plateau and the Mogollon Rim; it has met limited success in studying cultures of the low deserts, such as the Hohokam of the Sonoran Desert and Patayan of the lower Colorado River, where cottonwoods predominate, or in the Eastern Woodlands where there is little moisture stress. It is also more successful in areas where large quantities of wood were used for construction, as on the Colorado Plateau, than in the Great Basin, where most domestic structures were ephemeral.

Despite these recognized problems, dendrochronology is widely used today. The discipline has its own journal, and the University of Arizona is still the leading laboratory for tree ring research. Tree rings are still read visually, under a powerful microscope, although analysis is now computerized. In areas with the appropriate trees, such as southwestern Colorado and northern New Mexico and Arizona, it is extremely accurate, and can give tree cutting dates to a year, and sometimes even to a season within a year! It therefore continues to be a very valuable tool for archaeology.

Of course, corroborative techniques are needed, to cross-check tree-ring dates and to give quantitative dates in cases where tree rings do not work. In our next column we will continue with discussion of such a technique: radiocarbon.