14C Analysis Confirms the Annual Nature of Sagebrush Wood Layers

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Abstract

In the Great Basin of North America, big sagebrush (Artemisia tridentata Nutt.) growth rings can be used to reconstruct environmental changes with annual resolution in areas where there is otherwise little information available. We tested the annual nature of big sagebrush wood layers by means of accelerator mass spectrometry (AMS) radiocarbon (14C) dating. Four cross sections from three sagebrush plants were collected near Ely, Nevada, and analyzed using dendrochronological methods. Ten 14C measurements were then used to trace the location of the 1963-64 "bomb spike". Although the number of rings on each section did not exceed 60, crossdating was possible within a section and between sections. Years assigned to individual wood layers by means of crossdating aligned with their expected 14C values, matching the location of the 14C peak. This result confirmed the annual nature of growth rings formed by big sagebrush, and will facilitate the development of spatially explicit, well replicated, proxy records of environmental change, such as wildfire regime, in Great Basin valleys.

Dendrochronological Analysis

The sagebrush sections were sanded and polished until individual wood cells were clearly visible under a binocular microscope with 10-50x magnification. Calendar dates were then assigned to growth rings by means of visual crossdating, performed using skeleton plots. The number of rings on each section did not exceed 60, and the ring patterns were relatively uniform, but it was still possible to crossdate growth rings within a sample and across samples.

Radiocarbon Analysis

Radiocarbon amounts are given using the Fraction Modern (Fm) notation. Fm is a measurement of the deviation of the 14C/C ratio of a sample from a 1950 standard. The maximum error reported for the Fm measurements (see table on the left) was less than 0.6% of the measured value, and therefore negligible compared to the differences between years. Given the clear boundaries of wood increments in big sagebrush, the limited number of radiocarbon dates (5 from each of 2 sections) was adequate to answer the research question.

Measurements of Fm were compared with their expected values from 1950 to 1992, and years assigned to individual wood layers aligned with their expected 14C values, matching the location of the 14C peak (see graph below).

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