

¹⁴C measurement of the Southern Japanese tree by the AMS method for high-precision radiocarbon calibration

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Radiocarbon (¹⁴C) dating method has contributed to the age determination of samples of the past 50,000 years in geology and archaeology. However, since ¹⁴C date is not in agreement with the calendar year, the calibration using a dataset which consists of ¹⁴C data of calendar year known samples is required for it. Moreover, since there is regional difference of ¹⁴C concentration in the atmosphere (regional ¹⁴C offset; Hogg et al. 2002), in order to be high-precision calibration, the dataset for each area needs to be established.

The Center for Chronological Research (CCR), Nagoya University has measured ¹⁴C data of tree-rings of a Yaku cedar from the Southern Japan, in order to establish a calibration dataset for Japan. Previous measurement has shown that the cedar shows ¹⁴C date older than global standard calibration dataset IntCal13 (Reimer et al. 2013) in various times for the past 2000 years (Nakamura et al. 2013). This report shows the measurement result of the tree-rings formed in the 5th century.

Sample is a Japanese cedar from Yaku Island, Kagoshima prefecture (sample code: Yaku_A). Dendrochronological analysis with a master-chronology (Kimura unpublished) has carried out, and the calendar year of this sample is known. After exfoliating the annual rings of AD434-502 of a sample in one year respectively, only even-numbered years was measured (n = 35). The tandemron AMS II of CCR was used for this measurement. Measuring only even-numbered years in order to understand a whole tendency previously, it also measures the samples of odd-numbered years in the future.

Thirty five ¹⁴C dates of tree-ring samples showed that it will be older than IntCal13 for an average of 28 ± 22 years, a maximum of 76 ± 21 years (in AD488). These ¹⁴C dates were mostly located in the middle of IntCal13 and SHCal13 (the calibration dataset for the Southern Hemisphere; Hogg et al. 2013).

Since Yaku Island touch the northernmost end of the Intertropical Convergence Zone in a summer, it is thought that the Southern Hemisphere atmosphere with regularly low ¹⁴C concentration is easy to be supplied (Nakamura et al. 2012). This measurement result might suggest that ¹⁴C concentration in the atmosphere of the Japanese neighborhood fell in the 5th century, and the atmospheric supply from the Southern Hemisphere may have become strong. Sakamoto et al. (2013) measured the tree-ring samples in the 5th to 6th century of the Japanese cedar from Nagano Prefecture Central Japan, and they has reported that the data is older than a IntCal13. Our result harmonizes with the measurement result of the trees from Nagano, and this time can consider a possibility that the influence of the Southern Hemisphere atmosphere had reached to central Japan. From now on, the tree-rings of Yaku cedar in formed the 6th century will measure, and it will compare with the result of Sakamoto et al. (2013).

Keywords: radiocarbon calibration, regional ¹⁴C offset, Southern Japan, tree-ring, Yaku cedar