

Chronology by ¹⁴C analyses of wood circles excavated at the Mawaki site facing on Toyama Bay, in Noto Peninsula

NAKAMURA, Toshio^{1*}, Hiroshi Nishimoto², Hideki Takada³

¹Center for Chronological Research, Nagoya University, Professor, ²Faculty of Law, Aichi University, ³Noto-Town Board of Education, Ishikawa Prefecture

The Mawaki archaeological site, one of the biggest archaeological sites in central Japan, is located on the alluvial coastal plain facing to the Toyama bay at Noto peninsula, Central Japan. Excavation surveys at the site revealed that the site had been continuously occupied from the Early to Final Jomon periods (ca. 5200 cal BC - 500 cal BC). In the final stage of the site, wooden circular structures, peculiar to this region, were constructed. At the Mawaki site, totally 31 wooden poles have been excavated. The circular structures were discovered for the first time during the excavation in 1982-83, and confirmed explicitly in 2002-04. According to the archaeological studies, the combinations of 6-10 poles among these 31 wooden poles formed 6 independent circular structures (designated as Circles A to F). All wooden poles are chestnut trees, being cut in half vertically and possessing no bark. The biggest pole belonging to Circle A is about 1 m in diameter, and 10 poles were used to make up the Circle A. Each pole was set up in a pit of about 10-70 cm in depth from the ground surface. Diameter of the circles is about 5-7m, and circles A and B have a gate-like structure. The six structures overlapped each other at limited areas indicating that these structures had been rebuilt five times consecutively. Among the archaeological sites well-known for the wooden circular structures, the Mawaki site has the most typical structures and the wooden poles were well preserved against weathering. Therefore, the circular structures at the Mawaki site are suitable for chronological studies.

The ¹⁴C wiggle-matching technique normally uses ¹⁴C ages of several annual rings from the same wood. The radiocarbon community has developed internationally accepted data sets that describe the relation between ¹⁴C ages and tree-ring ages (IntCal09). The ¹⁴C ages of successive rings of sample wood are compared with those of the IntCal09 calibration data set by shifting the annual-ring number on the calibrated-age axis. Then the most probable calendar date is obtained for the outermost ring of the sample wood by using all the ¹⁴C ages measured for annual rings.

This analysis was applied to wood samples, belonging to individual sets of wooden circular structures excavated at the Mawaki site, to estimate calendar age values of their outer-most rings accurately, and the formation age of each structure was estimated. For Circle A, 4 wooden poles and one wooden plate were analyzed and it was concluded that calendar age of its construction was about 820-770 cal BC. Also, the analysis was conducted for 2 wood poles belonging both Circles D and E, for one wood pole belonging definitely to Circle E, 2 wood poles belonging to Circle F. However, clear results were not obtained, because of the flat ¹⁴C age structure against calendar age on this age periods in the IntCal09 calibration dataset. Calendar ages assigned briefly for the circles are: 770-740 cal BC for Circle D; 690-540 cal BC for Circle E; 740-680 cal BC for Circle F. The wood samples belonging to Circles B and C were impossible to collect this time. The ¹⁴C age, 2655±25 BP, for the outermost ring of wood belonging to Circle B obtained by the previous work was calibrated to be 890-790 cal BC. The present experiment suggests that the formation of wooden circular structures lasted from 890 cal BC to 540 cal BC at the Mawaki site.

By applying the wiggle-matching analysis to 5 wood samples from Circle A structure at the Mawaki site, we were successful to assign the period of its formation in 50 years range. However, for other circles that can provide only limited number of wood poles to the wiggle-matching analysis, the precision of the age estimation was not good. The poor precision also resulted from the flat ¹⁴C age structure against calendar age around this age periods in the IntCal09 calibration dataset.

Keywords: ¹⁴C age, Jomon shell midden, wood circle, chestnut wood, ¹⁴C wiggle-matching, layer of dolphin bones