

RESEARCH REPORT

DENDROCHRONOLOGICAL DATING OF VERNACULAR FOLK CRAFTS IN NORTHERN CENTRAL JAPAN

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ABSTRACT

We dated vernacular folk crafts (traditional snow shovels) made of beech wood (*Fagus crenata* Bl.) in north-central Japan. A raw chronology was constructed for the folk crafts, spanning the period from 1721 to 1953 (233 years). The raw chronology was crossdated using a reference chronology in central Japan. Eventually, tree-ring dates were confidently determined for 26 out of 44 samples. The final tree-ring dates of the folk crafts ranged between 1872 and 1953. We used oral folkloric records collected in a public survey for comparison and verification of our results. The time period of use of the folk crafts was supposed to range between the late Meiji Period and the beginning of the Pacific War (World War II), and the tree-ring dates were generally consistent with the date range. However, the final tree-ring dates were after the Pacific War for two youngest samples, showing better agreement with the historical change in industry of modern Japan. The tree-ring dates demonstrate the potential to describe the historical use of the artifacts more accurately than the folkloric records. In addition, the existing site chronology of Japanese beech has been better replicated using the folk craft samples. The chronology can possibly be further extended using archaeological wood from historical buildings.

Keywords: Dendrochronology, tree-ring dating, Japanese beech, vernacular folk craft, folkloric record, Central Japan.

INTRODUCTION

The study of vernacular artifacts is of essential importance to more fully understand regional history in light of a broad array of cultural diversity. Japan has a long history of wood culture, and various wood species have been used not only for large architectural projects such as temples and shrines but also daily necessities. Above all, common people's lives were rarely documented, and therefore are known only through vague folklore or trivial artifacts.

Dendrochronology provides valuable insight into the history of wooden artifacts by assigning calendar dates. It also allows inference of the human past in the context of environmental and societal conditions (e.g. Towner 2002; Čufar 2007;

Eckstein 2007). In East Asia, dendroarchaeological dating has mainly been performed on several softwood species, e.g. Hinoki cypress (*Chamaecyparis obtusa* (Sieb. et Zucc.) Endl.), Hiba arborvitae (*Thujopsis dolabrata* (L.f.) Sieb. et Zucc. var. *hondae* Makino) and Japanese red pine (*Pinus densiflora* Sieb. et Zucc.), which were used favorably for historical buildings (e.g. Mitsutani 1995; Ohyama *et al.* 2007; Park *et al.* 2007). On the other hand, few studies have been achieved using hardwoods, although some may be amenable to dendroarchaeological dating (e.g. Nara National Cultural Properties Research Institute 1990).

Hoshino *et al.* (2006, 2008) developed a network of ring-width chronologies of Japanese beech (*Fagus crenata* Bl.) at the forest sites throughout central and northeastern Japan with the site-specific signature-year records. The network was subdivided into four geographical regions based on the correlations of the chronologies.

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In this study, we attempted to date vernacular folk crafts (traditional snow shovels) made of beech wood in north-central Japan with a regional reference chronology. We performed a comparative study on the tree-ring dates with regional folkloric records.

HISTORICAL BACKGROUND

Japanese beech is distributed widely throughout Japan, and often dominates in cool-temperate deciduous forests. In general, Japanese beech did not provide useful wood because of its low resistance to biodegradation and unfavorable color (darker color of beech heartwood was not esthetically acceptable except for handicrafts) as well as limited availability. Many old-growth forests are thus still preserved in the snowy, mountainous regions along the Japan Sea coast, where the wood had been used for handicrafts but rarely for construction (e.g. Ihara 1988; Yamada 1993). A number of traditional folk crafts made of beech wood are still preserved and maintained as folkloric-cultural properties.

The spatular snow shovel was an essential tool for life in snowy regions. Those made of a single piece of wood are typical in Japan (Ujiie 1989). Antique snow shovels made of beech wood were described with respect to the life style of the snowy countryside in the Japanese classical literature '*Hokuetsu seppu*' compiled in the middle Edo Period (early 17th Century) (e.g. Hunter and Lesser 1986 for English literature). This wooden tool was widely used not only as a snow shovel but also as a spatula for '*Miso*' (fermented soy bean paste) brewing, thus having several dialectal names such as '*Banba*' (word origin unknown) used in the study area, '*Kosuki*' (literally, wooden spade) northeast of the study area, etc. (Hunter and Lesser 1986; Yamada and Okazawa 1997).

MATERIALS

Samples of 48 traditional snow shovels were provided from the Hida-Miyagawa Museum for Archaeology and Folklore, Gifu Prefecture, north-central Japan (Chubu District) (Figure 1). The artifacts were probably all made by hand,

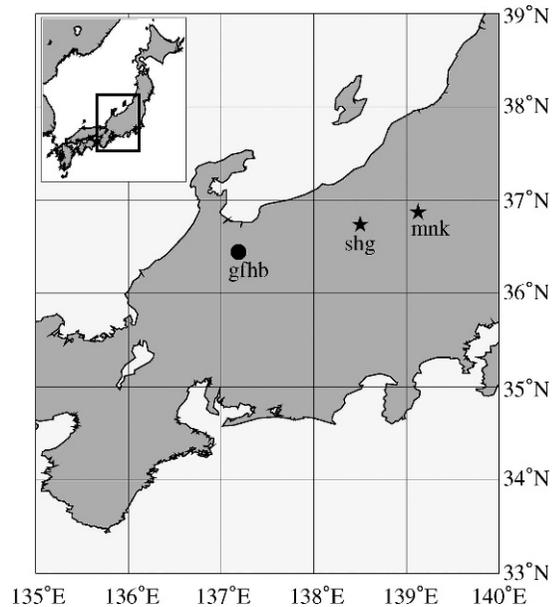


Figure 1. Map of central Japan showing the study area (circle, gfhb=Hida-Miyagawa, Gifu) and the forest sites of the reference chronologies (stars, mnk=Minakami; shg=Shigakogen).

because we found knife marks by a hand tool (chisel or ax) on some of the samples. Figure 2 shows examples of the snow shovels. Such snow shovels were manufactured from a single radial plank. Nine samples had bark or a wane edge (terminal ring). We excluded four samples from

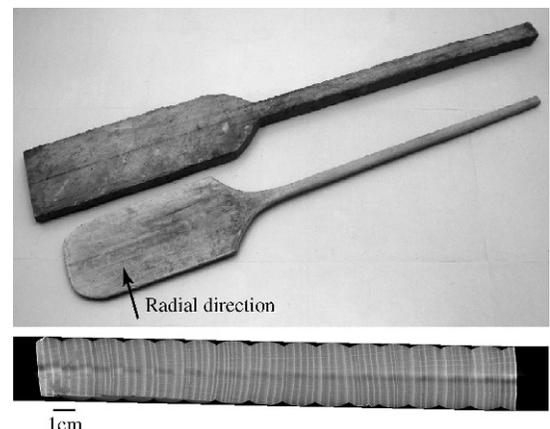


Figure 2. Traditional snow shovels made of Japanese beech wood (top) and the X-ray CT image of the cross-section (bottom). Length of shovels is ca. 2 m.

Table 1. Timeline of modern Japanese history.

	Japanese era calendar	Gregorian calendar (AD)
Early modern Japan (Edo Period, AD1603-1886)	Keio 1–4	1865–1868
Modern Japan	Meiji 1–45	1868–1912
	Taisho 1–15	1912–1926
	Showa 1–64	1926–1989
	Heisei 1–present	1989–

the dating exercise because they had less than 50 rings (see *e.g.* English Heritage 2004).

Prior to our study, the above-mentioned museum had already conducted a public survey in order to gather folkloric records that were kindly made available to us. The survey included interviews with the donators about manufacturers, users (*e.g.* role in the family), and time periods of use. Based on the records, the snow shovels had been produced and used in the Hida-Miyagawa Village (36°23'N, 137°11'E) and its vicinity. The typical time period of use was before or after the Taisho Period. It is supposed to range between the late Meiji Period and the beginning of the Pacific War (1941) in the Showa Period (see Table 1).

METHODS

Coring of the samples was prohibited, but rings with clear boundaries could be seen on most of the samples. For one sample, we non-destructively acquired the grey-scale images of the cross-sections using micro-focus X-ray computed tomography (Okochi *et al.* 2007). Ring widths were measured on the samples or the image to an accuracy of 0.01 mm.

Semi-logarithmic plots of the raw ring-width series were used for the visual crossdating. The visual matches of the series were simultaneously checked by Student's *t* value (Baillie and Pilcher 1973) and sign test (Gleichläufigkeitswert, hereafter *G* value; Eckstein and Bauch 1969) using the program PAST4 (SCIEM). The *t* values were computed using the series indexed by a five-year running mean.

For the purpose of this study, we developed a new, well replicated reference using two site

chronologies of central Japan (Minakami ($n = 11$) and Shigakogen ($n = 7$), Hoshino *et al.* 2006). The raw ring-width series at the two forest sites were simply averaged to generate the composite reference chronology.

We examined cross-matching between the individual samples. A floating raw chronology was constructed as an ensemble mean of the successfully crossdated series. The floating chronology was crossdated with the reference. Each of the sample series was then examined using both the reference and the raw chronologies as an additional check.

Skeleton plotting did not work well in our dating of Japanese beech. This may be attributed to the previous findings (Hoshino *et al.* 2006, 2008) that the signature years in the Japanese beech chronologies do not always correspond to the abrupt growth depressions, which agree rather well with the records of good masting.

RESULTS

As shown in Figure 3, we observed a good match between the reference and the floating chronology for the samples. The *t* value of 5.4 (overlap = 233) supports the above-mentioned visual assessment. Finally, the dated chronology of the samples spanned the period from 1721 to 1953 (233 years).

Eventually, we dated 26 of 44 samples (*ca.* 59%), whose crossdating statistics are shown in Table 2. The *t* and *G* values were higher than 6.0 and 60.9%, respectively, suggesting a high degree of correspondence between the reference and each of the dated samples. With respect to the samples with a terminal ring, the final tree-ring dates ranged between 1889 and 1953 (Figure 3b). The other samples showed a similar range. It is notable that even those with relatively short length (*e.g.* gfhb017 and gfhb094) were crossdated confidently with high values of the crossdating statistics. The final tree-ring dates of the snow shovels ranged between 1872 and 1953.

DISCUSSION AND CONCLUSIONS

We have confirmed that the tree-ring dates of the folk crafts roughly cover the date range

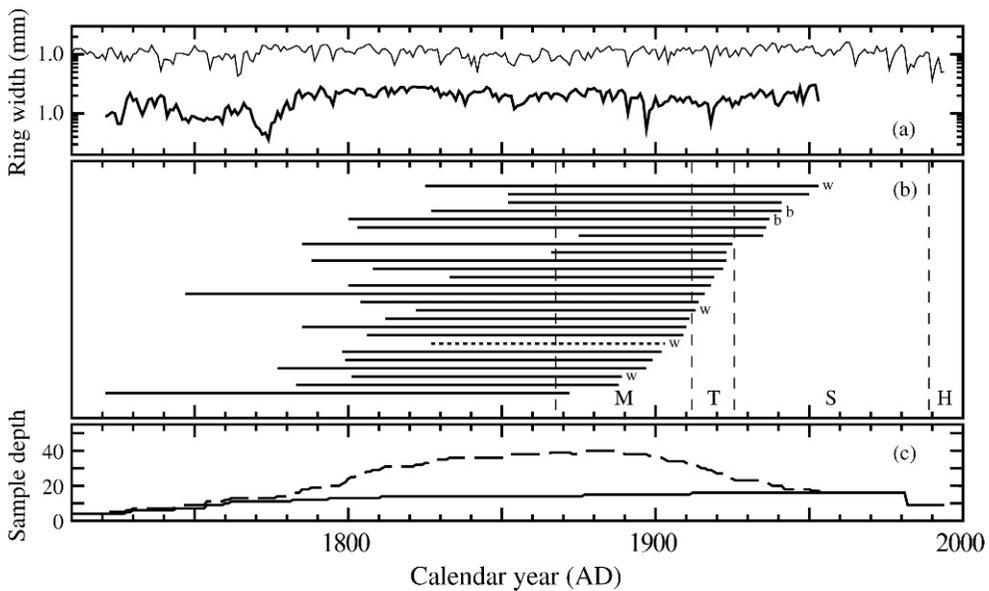


Figure 3. (a) Raw chronology for folk crafts (bold line) crossdated by the reference chronology in central Japan (thin line), (b) horizontal bar plots of the individual tree-ring series of the folk crafts (horizontal dotted line=X-ray CT measurement, b=bark, w=waney edge, M=Meiji, T=Taisho, S=Showa, H=Heisei), and (c) sample depth for the living trees of central Japan (solid line) plus the folk crafts (dotted line).

between the late Meiji Period and the beginning of the Pacific War (World War II) supposed from the folkloric records. However, it should be noted that two samples (1953 for gfhb036 and 1950 for gfhb127) do not fall within the date range given by the folkloric records. This contradiction could be related to the drastic change in social values in Japan since 1945. The 1950s were the beginning of rapid economic growth, when traditional cultures were losing their influences on the lifestyle. During that time period, machinery was heavily introduced and came into wide use in the industrial sectors including woodworking (Hino 1987). Since the 1960s, wooden daily necessities were mostly replaced by those made of metals and plastics. Iron-made snow shovels were first produced in 1961 (Ujiie 1989). It can be concluded that the tree-ring dates in this study show better agreement with the industrial history in Japan than with the folkloric records. On the other hand, the donator's perception was likely that the folk crafts are merely obsolete, old-fashioned tools in the pre-modern times. This result is the first successful application of dendroarchaeological dating in the context of industrial archaeology in Japan.

The newly built reference chronology is valuable for dendroarchaeological dating, with sufficient sample depth from both the reference samples plus the wooden artifacts dated in this study (Figure 3c). Unfortunately, we could not extend the existing reference. The Japanese beech chronology in central Japan is now better replicated by incorporating the samples in this study.

With respect to the undated samples, two possibilities can be considered for lack of successful dating. The samples might come from remote areas, or are too old to obtain sufficient overlap in cross-matching. We subsequently attempted cross-dating trials with other site chronologies (Hoshino *et al.* 2006) in northeastern Japan, with which we were not able to match the ring-width series of the samples. The above-mentioned possibilities therefore cannot be rejected as of now. However, old timbers and logs of Japanese beech from the 14th to 19th Centuries have been excavated in the archaeological studies of temples and vernacular architecture (*e.g.* farm houses) on north-central and northeastern Honshu Island, Japan (Ihara 1988; Yamada 1993). Future efforts should concentrate on extending the existing Japanese beech

Table 2. Results of statistical crossdating for the antique snow shovels. b=with bark, w=with waney edge, *t*=Student's *t* value, *G*=Gleichläufigkeitswert (sign test). The raw chronology was crossdated with the reference of central Japan. The *t* and *G* values of each sample were against the raw chronology.

Sample No.	No. of rings	Outside tree-ring date			Terminal ring	<i>t</i>	<i>G</i>
		AD	Japanese era				
gfhb036	129	1953	Showa	28	w	9.1	72.9
gfhb110	115	1941	Showa	16	b	7.1	68.7
gfhb101	138	1937	Showa	12	b	8.6	60.9
gfhb017	58	1923	Taisho	12	w	10.4	79.3
gfhb129	92	1913	Taisho	2	w	9.1	63.0
gfhb086	77	1903	Meiji	36	w	9.4	64.3
gfhb087	89	1889	Meiji	22	w	8.5	68.0
gfhb127	99	1950	Showa	25	-	7.7	65.7
gfhb123	90	1941	Showa	16	-	7.2	66.7
gfhb027	134	1936	Showa	11	-	13.0	72.0
gfhb094	61	1935	Showa	10	-	10.0	78.7
gfhb088	141	1925	Taisho	14	-	10.8	68.8
gfhb089	136	1923	Taisho	12	-	13.5	78.3
gfhb063	115	1922	Taisho	11	-	12.0	73.5
gfhb025	87	1919	Taisho	8	-	6.1	62.1
gfhb106	119	1918	Taisho	7	-	6.0	72.3
gfhb120	170	1916	Taisho	5	-	11.2	72.4
gfhb112	111	1914	Taisho	3	-	6.0	64.0
gfhb107	100	1911	Meiji	44	-	7.6	71.5
gfhb092	126	1910	Meiji	43	-	9.4	73.0
gfhb118	104	1909	Meiji	42	-	12.4	76.9
gfhb113	105	1902	Meiji	35	-	7.1	62.4
gfhb114	101	1899	Meiji	32	-	7.2	72.3
gfhb093	121	1897	Meiji	30	-	6.5	67.4
gfhb001	106	1888	Meiji	21	-	8.5	75.9
gfhb119	152	1872	Meiji	4	-	10.6	81.6
Raw chronology	233	1953	Showa	28	-	5.4	63.5

chronologies back into the past and developing site chronologies in other regions.

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