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Building *Quaksweaqwul*: Dendroarchaeological investigations at *Kiix?in* National Historic Site, Vancouver Island, Canada

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Abstract

A dendroarchaeological survey of a traditional Nuu-chah-nulth plank house at *Kiix?in*, the former capital of the Huu-ay-aht First Nations, on the west coast of Vancouver Island British Columbia, was undertaken in the summer of 2002. Standardized dendroarchaeological techniques were employed to collect and analyse increment core samples collected from the house known as *Quaksweaqwul*. Floating ring-width series were compared to a locally prepared Western redcedar (*Thuja heterophylla*) master tree-ring chronology (1511–2002 AD) to determine when the trees used to construct the house were felled. The findings of the survey indicate that *Quaksweaqwul* was built after the 1835 AD growth year. As the amount of perimeter wood loss due to weathering and preparation is difficult to ascertain, no precise felling or construction date can be presented.

The results of this survey provide insights into Huu-ay-aht First Nations history and offer direct evidence for the general state of preservation of individual house posts and beams at *Kiix?in*. Additionally, the successful dating of a traditional First Nations village using a dendroarchaeological approach highlights the potential this technique may hold for developing similar insights at other sites along Canada's Pacific Coast.

Keywords: Huu-ay-aht First Nations; Kiix?in; National Historic Site; plank house; dendroarchaeology; Western redcedar; *Thuja heterophylla*

Introduction

Prior to and for about a century following contact with Europeans the Nuu-chah-nulth[1] First Nations of the west coast of present day Vancouver Island, BC, Canada lived during the winter in coastal settlements consisting of large wooden post and beam plank houses fronting on the ocean. Seasonally, they moved to smaller sites, often taking the wall and roof planks from the winter houses to those seasonal villages and camps that had permanent house frames.

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[1]The Huu-ay-aht First Nations are one of 15 politically separate Aboriginal groups who presently make up the Nuu-chah-nulth. The Nuu-chah-nulth, once mistakenly referred to as the "Nootka", are speakers of "Nootka" and "Nitinaht", two members of the Wakashan language family. Readers should note that the "?" in *Kiix?in* and other Nuu-chah-nulth words in this paper represents a glottal stop and is a

(*footnote continued*)
version of the orthography favoured by Arima who notes that it is "a catch of breath like that in the middle of saying 'uh-huh'" (1983, p. 197).

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Of the many Nuu-chah-nulth (meaning "all along the shining mountains", Arima, 1983, p. v) local groups that once existed (McMillan, 1999), only a few survived the epidemics and historical conflicts that began with the arrival of European explorers in the late 18th century (Arima and Dewhirst, 1990; Boyd, 1999). By the end of the 19th century it is estimated that only 3000–3500 Nuu-chah-nulth people remained; representing a population decline of 80% over less than 125 years (McMillan, 1999, p. 193; Huu-ay-aht First Nations, 2000, p. 39). As a result of the profound change arising from contact with Europeans, many local groups began living in villages amalgamated from several former settlements.

In this paper, we discuss one house from the Huu-ay-aht (meaning "the people" [*aht*] of "*Huu-ay*") First Nations village named *Kiix?in*, located on the south east corner of Barkley Sound on the west coast of Vancouver Island (latitude 48°48′47″N; longitude 125°10′36″W). Huu-ay-aht histories indicate they have occupied their territory 'since time began' (Huu-ay-aht First Nations, 2000).

Kiix?in is named as the capital city of the Huu-ay-aht First Nations (2000), and archaeological evidence indicates the site has been occupied for thousands of years (Sumpter, 2003). Late in the pre-contact period, however, *Kiix?in* was attacked by the Klallam, a Salishan group who drove out the Huu-ay-aht (St. Claire, 1991). It is not precisely known when the Huu-ay-aht returned and reclaimed their village from the Klallam, but it was likely several decades before 1850 (Huu-ay-aht First Nations, 2000, p. 53). Contemporary sources indicate, however, that in 1858 *Kiix?in* was again the principal community of the Huu-ay-aht (Banfield, not datable). A census at *Kiix?in* in 1874 records that 246 people were living in 10 houses, with from 11 to 40 occupants per house (Blenkinsop, not datable). The Huu-ay-aht occupied *Kiix?in* until the 1880s or early 1890s, when they moved across Trevor Channel to live at the villages of *Chapis* and *?A:?at-sow* in the nearby Deer Group Islands (Huu-ay-aht First Nations, 2000, p. 37).

Today the village of *Kiix?in* contains the best preserved remains of any *Nuu-chah-nulth* traditional village. The overgrown houses evoke images of people and events from times past for the Huu-ay-aht (Huu-ay-aht First Nations, 2000, p. 35). The Huu-ay-aht First Nations have a strong desire to share their heritage, knowledge, histories, and traditions with other Canadians and the world. This is signified through their willingness to have *Kiix?in* designated a National Historic Site of Canada, and by their invitation to complete a dendroarchaeological investigation at *Kiix?in* to compliment their desire to educate people about their traditions, culture, and history.

In August 2002, with the permission of the Huu-ay-aht First Nations we completed a dendroarchaeological investigation at *Kiix?in*. The extant remains of post and beams from eight houses paralleling the shoreline are present within the village (Huu-ay-aht First Nations, 2000; Mackie and Williamson, 2003; Sumpter, 2003). Many of the vertical roof support posts are still upright, with some still supporting structural beams. This paper focuses on the approach we used to date the construction of the house named *Quaksweaqwul* (meaning "like water against a canoe when a whale was taken alongside", Huu-ay-aht First Nations, 2000, p. 50).

The *Quaksweaqwul* case-study

In the early 1920s, Alfred Carmichael visited *Kiix?in* and later determined that *Quaksweaqwul* belonged to either "Beaver Charlie" and "Mr. Sport", or to *Too.tis.mis* (Carmichael, not datable). This house has an unusual double rafter beam in the front, and a flat shed roof that sloped from front to back (Fig. 1) and is architecturally distinct from the shed-roof houses found to the south and east of Barkley Sound (Mackie and Williamson, 2003). The rafter and eave beams, and the corner posts of *Quaksweaqwul* are hewn from mature Western redcedar (*Thuja plicata* Donn ex D. Don) trees.

Detailed mapping of house elements revealed *Quaksweaqwul* has an area of 185 m^2, is 15.5 m in average length along the beach, and has an average width of 12 m (Mackie and Williamson, 2003). The walls range between about 3.4 and 4.9 m in height above the house floor. Of special note are the two fluted rear corner posts (Fig. 2). In addition to supporting the rear corner roof beams, these posts would have represented ceremonial presentation and wealth (*tuupaati*) of a chief (*ha'wiih*).

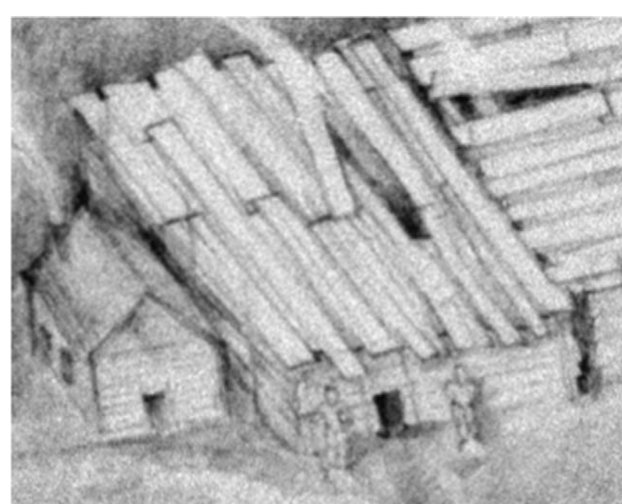

Fig. 1. Reconstruction drawing of *Quaksweaqwul* showing what the house may have looked like during the mid- to late-1800s. From drawing prepared by Lori Graves (1985).

Fig. 2. *Quaksweaqwul* house, rear east corner, Post E (outer ring 1700 AD), showing fluted adzing and rear beam (outer ring 1834 AD) leaning against top post. Note nurse tree growing over post and beam (photograph: Arlene Suski, Parks Canada).

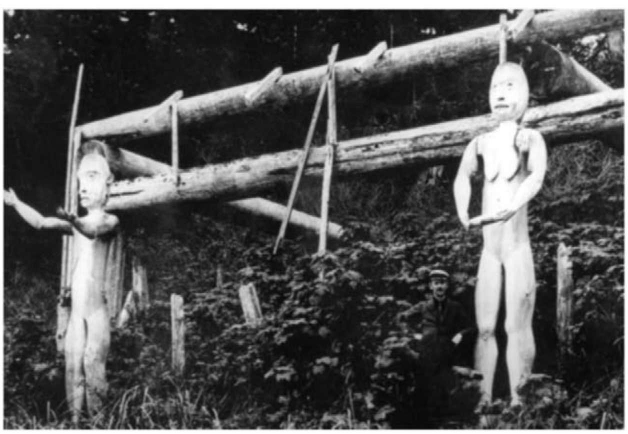

Fig. 3. *Quaksweaqwul* house and "welcome figures" before 1911. Photograph attributed to C. Bradbury, PN 4659 (courtesy Royal British Columbia Museum, Victoria).

An interesting feature of *Quaksweaqwul* were two *tuupaati* "welcoming figures" that fronted the house (Fig. 3). Raised to honour a marriage between the Huu-ay-aht and Makah Nations, the figures represent histories of a time when the first man ("*Nutchkoa*") and early ancestress woman ("*Ho-miniki*") "came down" from the heavens in Huu-ay-aht territory (Huu-ay-aht First Nations, 2000, p. 50). These figures now welcome visitors at the main entrance of the Royal British Columbia Museum at Victoria, BC (Huu-ay-aht First Nations, 2000).

Research methodology

Prior to the investigations reported here, it was not precisely known when the *Kiix?in* houses were built (Florian, 2001). The intention of our investigation was to use a standardized dendroarchaeological research approach to confirm when *Quaksweaqwul* was constructed.

Chronology building and cross-dating provide a simple and effective tool for the dendroarchaeological dating of historic structures (Baillie, 1982). Although this methodology had not previously been used to date the construction of First Nation villages in Pacific North America, dendrochronological techniques have successfully been employed to date both culturally modified trees (CMTs) (e.g., Mobley and Eldridge, 1992; Pegg, 2000) and historic cabins in western Canada (e.g., Smith, 2000; Brelsford, 2004).

In order to determine the date of construction of *Quaksweaqwul*, tree-ring samples were collected from all solid beam and posts in a manner that caused minimal damage. This was accomplished by extracting tree core samples with the use of a two-thread 5 mm increment corer. Whenever possible, the hole created by the corer was filled with a cork plug to discourage weathering.

House element numbers assigned during earlier studies were reused; the house number (8) is followed by a post or beam letter (Mackie and Williamson, 2003; Sumpter, 2003). Increment core samples were extracted from nine wood elements (four posts and five support beams). For the most part beams suspended above the forest floor proved to be reasonably solid. Surface rotting and perimeter wood loss was, however, evident on beams found lying on the ground. By contrast, all of the corner support posts were partially or completely rotted. This limited their dendroarchaeological utility, as does the fact that many appear to have been more deeply trimmed or decorated than the beams.

Two increment core samples were extracted, approximately 180° apart, from the largest radius section of each beam and post. The samples were transported in plastic straws to the University of Victoria Tree-Ring Laboratory where they were prepared for analysis according to standard dendrochronological procedures (Stokes and Smiley, 1968). After air-drying, each core was glued into a grooved board, labelled, and prepared for analysis by sanding with progressively finer grades of sand paper (100–800 grit). Cores were then hand-polished to enhance the definition and contrast of the annual tree-ring boundaries.

All the increment core samples were examined using a digital and/or a manual measuring system. Samples were first converted to high-resolution digital images (800–2000 DPI) with an Agfa Duoscan scanner. Annual rings were then counted and measured to the nearest ± 0.01 mm using a WinDENDRO (Version 2002a) digital tree-ring image processing system (Guay et al., 1992). Counts of the annual rings were repeated on a Velmex-type measuring stage using a Wild M3B stereomicroscope until the total number of rings counted could be replicated. Any significant anomalies in the annual rings, such as scars or distinctly wide or narrow rings, were recorded. Each set of measured ring widths was visually cross-dated to the replicate sample collected from each wood element. The cross-dated time-series were then quality checked using the International Tree-Ring Data Bank (ITRDB) software program COFECHA (Holmes, 1999). Any erroneous segments were then corrected (i.e., remeasured) or deleted from the combined data set until a statistically significant undated tree-ring series was produced for each element.

The floating tree-ring series were subsequently individually compared to a local Western redcedar master chronology prepared for dating the house elements at *Kiix?in*. The master chronology was constructed from increment core samples extracted from 38 living Western redcedar trees located along the nearby shoreline ($n = 20$) and within the adjacent forest ($n = 18$). Fig. 4 presents a graphic representation of the master *Kiix?in* Western redcedar chronology used in this analysis. Changes in the annual tree-ring-width indices are plotted as a function of time.

The master chronology spans the interval between 1511 and 2002 AD (series correlation 0.431; mean sensitivity 0.168; autocorrelation 0.8). Growth trends in the early part of the chronology are quite variable and are an artefact of the limited sample depth. Intervals of reduced growth rates occur from 1600 to 1650, 1690 to 1765, 1800 to 1820, and 1835 to the 1860s AD. Lesser episodes of reduced growth occur in the 20th century, from 1915 to 1930 and again in the 1970s. Notable intervals of above average growth occurred in the late 1600s, late 1700s, and early 1900s AD. Spectral analysis of the chronology reveals statistically significant peaks at 24–25 and 61 years, highlighting the impact of the Pacific Decadal Oscillation (PDO) on radial growth trends (see Gedalof and Smith, 2001).

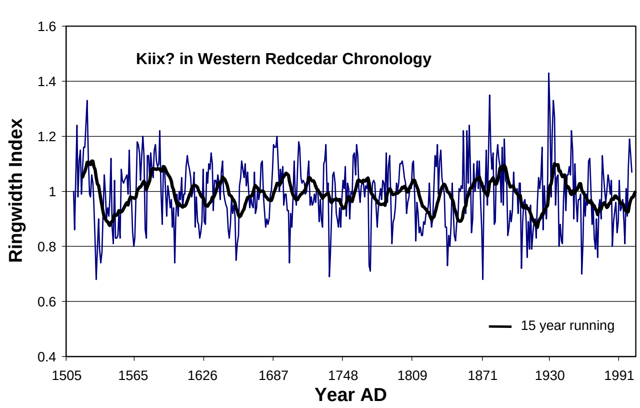

Fig. 4. The *Kiix?in* Western redcedar master tree-ring chronology (1511–2002 AD). The 15-year running mean emphasizes extended periods of enhanced and reduced tree-ring growth.

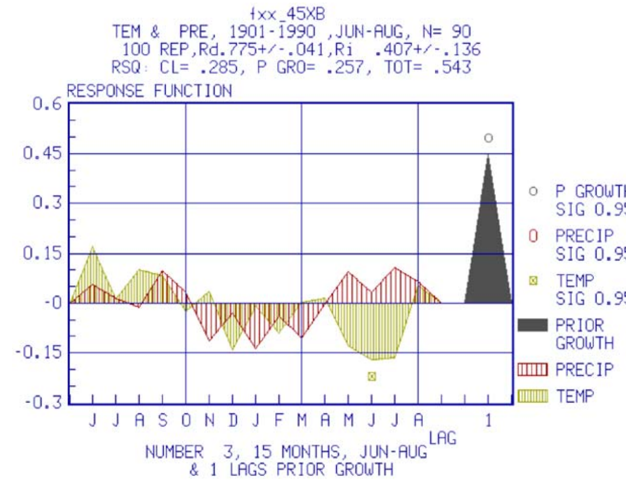

Fig. 5. Response function analysis showing the relationship between climate and radial growth in the *Kiix?in* Western redcedar master chronology.

As low-elevation coastal temperate rainforests along Pacific North America inhabit an environment with few climatic limitations (see Lertzman et al., 2002), the *Kiix?in* Western redcedar master chronology was examined to confirm it retained a climate signal sufficient to allow for reasonable cross-dating. Fig. 5 shows the growth response of the living redcedar trees to temperature and precipitation data from the Port Alberni climate station (1900–1990 AD). The figure illustrates the amount of variation in ring width explained by temperature and precipitation over a 15-month interval, from June of the previous year to August of the growth year. A 15-month growth period was used to capture the annual growth signal, as coniferous trees are often influenced by growth in the preceding year. This response function analysis reveals a strong positive response to mean June temperature of the growing season. Of the 54% variation in annual radial growth explained by the climate response function, almost equal proportions are attributed to climate in the growth and proceeding year. In the *Kiix?in* study, confirmation of this climate–radial growth relationship verifies the potential utility of the chronology for cross-dating purposes.

Results

Despite falling out of use over a century ago, and having partially or completely collapsed, the suspended beams at *Quaksweaqwul* remain largely solid beneath a thin perimeter of rotting wood. On the other hand, collapsed beams found lying on the ground were characterized by rotten centres and missing piths. By contrast, all four of the *Quaksweaqwul* corner posts, despite their solid external appearance (Fig. 2), are in a state of advanced internal disintegration.

The *Quaksweaqwul* wood elements all retain less than 250 annual growth rings (Table 1). As bark was not detected on any of the samples, and surface rotting and weathering was commonplace, our analyses do not allow for the designation of precise felling or construction dates. While narrow perimeter ring sequences in the corner posts suggest that substantive old growth trees were preferentially selected to add structural strength to the wooden frame of *Quaksweaqwul*, it was readily apparent that decorative adzing (see Drucker, 1951) substantially reduced their dendroarchaeological utility.

Table 1 reveals that the majority of *Quaksweaqwul* wood elements cross date significantly with the living Western redcedar chronology developed as a component of this study. Our results indicate that *Quaksweaqwul* was constructed from timbers felled sometime after the 1835 growth year (beam 8K, Fig. 6). This finding is substantiated by the cluster of beam perimeter dates that all fall between 1792 and 1835. Cross-dating results from the corner posts are inconclusive, as we interpret the perimeter dates (youngest 1773 AD; 8F, Fig. 6) as minimum ages which reflect wood loss due to decorative adzing. It is possible that the corner posts are older and from a pre-existing structure, especially so as the Nuu-chah-nulth continually replaced and/or reassembled their houses when they showed signs of rotting out (Drucker, 1951, pp. 72–73). Nevertheless, close examination of the ring patterns within the corner posts suggests that they may be hewn from a single tree. If further research substantiates this observation, given the 1773 perimeter date obtained for post 8F and the degree of implicit surface adzing on the rear corner posts (outer ring dates are ~1641 and 1676, 8A and 8E, Fig. 6), it

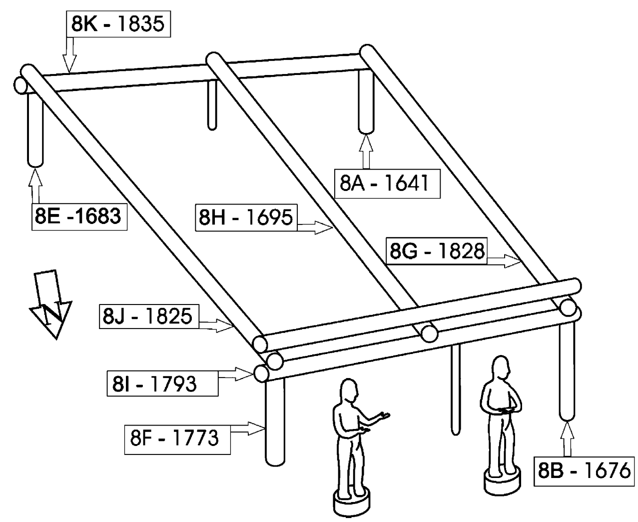

Fig. 6. Reconstructed frame of *Quaksweaqwul* showing outermost perimeter date of posts and beams established by cross-dating to living Western redcedar chronology (adapted from Mackie and Williamson, 2003).

Table 1. Results of tree-ring sample analysis at *Quaksweaqwul*

House element number	Description of element	UVTRL core sample no.	Maximum number of tree rings	Correlation with master chronology	Calendar year of outer tree ring
8A	Post	HKS1Y1	91	0.254	~1641
		HKS1Y2	120	—	—
8B	Post	HKS1L1	162	0.345	1672
		HKS1L2	76	0.413	1676
8E	Post	HKS1E1	171	—	—
		HKS1E2	177	0.464	1683
8F	Post	HKS1M1	86	—	—
		HKS1M2	87	0.331	1773
8G	Beam	HKS1A1	163	0.365	1789
		HKS1A2	249	0.487	1828
8H	Beam	HKS1B1	101	—	—
		HKS1B2	158	0.395	1695
8I	Beam	HKS1C1	45	—	—
		HKS1C2	96	0.515	1793
8J	Beam	HKS1D1	174	—	—
		HKS1D2	183	0.407	1825
8K	Beam	HKS1F1	86	0.550	1789
		HKS1F2	87	0.390	1835

seems more likely that dressing and decorating of the corner support posts resulted in the loss of greater than 100 years of tree-ring record.

Conclusions

A dendroarchaeological survey of the *Quaksweaqwul* post and beam house at *Kiix?in* on Vancouver Island shows that it was constructed of Western redcedar trees felled sometime after the 1835 growth year. Nevertheless, as the amount of perimeter wood loss due to weathering and preparation is difficult to ascertain, no precise felling or construction date can be presented. While this finding substantiates earlier suggestions that *Quaksweaqwul* and the other houses at *Kiix?in* were constructed in the early part of the 19th century, perimeter dates established for the other houses at the village indicate that at least some of the structures were built as late as 1850 AD (Smith, 2003).

This survey provides additional insights into Huu-ay-aht history and offers direct evidence for the general state of preservation of individual posts and beams at a long-disused house. While all of the posts and beams at *Quaksweaqwul* show some degree of surface weathering/rotting, the interior of most beams remains remarkably solid. By contrast, virtually all of the structural corner posts are in various states of disintegration and serve to emphasize the difficulties the Huu-ay-aht First Nation face as they develop a management plan for the site (Huu-ay-aht First Nations, 2000).

The *Quaksweaqwul* tree-ring dates amply demonstrate how living tree-ring chronologies can contribute to understanding the construction and habitation chronologies of traditional First Nations villages. Our discovery of a common growth signal within low-elevation Western redcedar trees suggests that the species has considerable dendroarchaeological utility beyond that described in this paper. Indeed, the successful dating of a traditional Nuu-chah-nulth house using a dendroarchaeological approach highlights the potential that dendroarchaeology may hold for developing similar insights at other cultural sites along the coast of the Pacific northwest.

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